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Errata.—Page 105, 11th line from top, read "The refuse contains abou
40 p. c. slate and 15 p. c. of sulphur."
" " 19th line from top, omit "roughly."

PROCEEDINGS.

TRANSACTIONS
OF
The Mining Society of Nova Scotia.

The Society as a body is not responsible for the opinions and views expressed in the several papers published in the Transactions.

Vol. VIII. Session 1903–04.

ANNUAL MEETING, FEBRUARY, 1903.

The annual meeting of the Mining Society of Nova Scotia was held in the Halifax Hotel, Halifax, on the 19th of February, 1903, at 11 o'clock, with the president, George W. Stuart, in the chair.

Among those present were: President George W. Stuart, of the Nova Scotia and Mexican Mining Co.; Hon. Robert Drummond, editor of "Maritime Mining Record"; Alexander McNeil, director Port Hood Coal Co.; Henry S. Poole, Charles C. Starr, of John Starr & Son; Fred. P. Ronnan, editor of "Industrial Advocate"; Prof. J. E. Woodman, Dalhousie School of Mining; Francis H. Mason, assayer; R. H. Brown, Charles Archibald; Clarence H. Dimock, manager of Wentworth Gypsum Co.; George S. Burritt, agent Canadian Rand Drill Co.; W. C. Milner, W. F. Jennison, of Dominion Iron and Steel Co.; J. G. Hudson, Sydney; Joseph H. Austen, of Austen Bros.; J. G. McNulty, of Nova Scotia Gold Mining Co.; M. R. Morrow, agent Dominion Coal Co.; F. W. Hanright, of Colonial Copper Co.; John H. Anderson, Duncan McDonald, manager Truro

Foundry Co.: Prof. D. A. Murray, Dalhousie College: A. N. Whitman, pres. Richardson Gold Mining Co.; John Johnson, of Nova Scotia Coal Co.; Prof. Ebenezer MacKay, Dalhousie College; Robert Dixon, of Strathcona Mine; George E. Boak; Geoffrey Morrow, of Wm. Stairs, Son & Morrow: Dr. A. H. MacKay, Superintendent of Education: Harry Piers, curator of Provincial Museum; Robert Kaulback, manager Touquoy Mine; G. S. Troop, of Black, Bros. & Co.: H. A. Sanders, of Forest Hill Mining Co.: H. Reid Harrison, of Cheticamp Gold Mining Co.; Todd C. Woodworth; James T. Burchell, manager Gowrie Blockhouse Colleries: E. Percy Brown, Thomas Caldwell, L. J. Hesslein; E. M. McDonald, M.P.P.: John R. McLeod; J. E. Hampson, and H. M. Wylde.

The Secretary read the minutes of the last meeting, which were confirmed.

ELECTION OF MEMBERS.

The following members were elected:—Arthur Roberts, Bridgewater; Edward James Cooper-Smith, Malaga; Francis Drake, Malaga: E. H. Emmerson, manager of the Waverley Gold Mining Company, Waverley; D. C. Hood, Waverley; F. B. Wade, K.C., Halifax; W. L. Lithgow, manager Port Hood Coal Co., Halifax: Cornelius Shields, vice-president Dominion Iron & Steel Co., Sydney; Harry Coll, manager of the Vale Colliery, Thorburn; J. L. Brass, manager Inverness & Richmond Railway Co.; R. A. C. McNally, agent James Cooper Manufacturing Co., Halifax; C. Ochiltree Macdonald, Halifax; Prof. J. E. Woodman, Dalhousie School of Mining, Halifax; G. Herrick Duggan, Dominion Iron & Steel Co., Sydney; J. G. Hudson, mining engineer: C. Crockett, New Glasgow; and John Johnson, resident manager N. S. Steel & Coal Co., Sydney Mines.

PRESIDENT'S ADDRESS.

THE PRESIDENT, GEORGE W STUART.—It is very pleasing to be able to refer to the healthy condition of the society, both financially and socially. In all such institutions unity of spirit stands paramount. A definite object, with the energy and application to overtake it comes next; and while we do not want enough cash in the treasury to generate the desire of spoilation, yet we require, and we have enough to keep the wolf from the door, appear decently clad, and also a few hundreds to spend for any good purpose looking to the protection of the society and the promotion of Nova Scotia's great mining industries.

We have now one hundred and fourteen members in good standing, an increase of twenty-seven in the last year. We are not called upon at this meeting to pass a single resolution of condolence; the "sting of the reaper" has not found a victim amongst us during the past year, for which we sincerely offer our grateful thanks to the Supreme Governor and Provider. The attendance at our meetings has been very good as compared with previous years. I would urge that every member attend at least one meeting each year.

We have had some excellent papers read, containing much valuable information, yet many more might and should have been contributed. I think it is the duty of each member to give the society, if possible, one paper each year—it is not expected that every member shall prepare a paper of exceeding merit. There are many things connected with the great mineral industry, both practical and technical, to write about; if one feels he cannot handle any of the larger subjects, let him give an hour to some of the innumerable smaller ones; if you cannot do better, submit some of the many questions that frequently confront us, for one of our chief aims is to give and to receive information.

The past year has been one of great and unprecedented activity in our mining and manufacturing enterprises. Never before in the history of this province has there been such a demand for labor, so many men employed, and such satisfactory wages paid. Work has gone on with a frictionless swing, showing the best of feeling between employer and employee, while our neighbors across the line have experienced from strikes the most disastrous year in their history, causing a shortage in their anthracite coal output of not less than twenty-eight million tons. Estimate, if you can, the financial loss and the physical suffering this national calamity has entailed. While we feel comparatively safe from such calamitous troubles, due to a superior and more intelligent class of employees and wiser and more generous management, yet it behooves us to be ever watchful. To the wage earner in whatever capacity he may serve, let me say that while all of us have our hopes and aspirations, yet a wise direction of our energies is required more than a " vaulting ambition which sometimes o'erleaps itself."

The output of coal during the past year has been no less than 4,362,869 tons of 2240 lbs., being 737,504 tons in excess of the previous year. 439,731 tons of iron have been manufactured into 206,193 tons of pig, against 90,034 tons manufactured in 1901 ; the greater portion of the ore, however, was brought from the Wabana mines, Newfoundland. The inducements offered by the government for the encouragement of the manufacture of iron and steel in this country should be so regulated as to insure the greater development of our own ore deposits.

There has been a falling off of 2,258 ounces of gold as returned to the mines office, as compared with 1901, when 30,537 ounces were returned. The past year's production is almost entirely from the larger and more modernly equipped mines, and from deeper workings, operations on most of the smaller mines having ceased. This is due largely to the fact that mine owners, having observed the successful operation of the more modernly equipped mines, are now less disposed to let their holdings to tributors, rather conserving their interests, looking forward to being able to work them on a larger scale. There are in process of construction throughout the various districts, a number of large and modern plants, both for milling and mining on a large scale and to much greater depths.

In all other branches of mining, except in barytes, there has been a large increase. May we not be warranted in believing that Nova Scotia is just now shedding the mantle which has so long covered her glory and is unbosoming a display of mineral wealth the magnitude of which must inevitably turn the eyes of the world's capitalists towards her?

In a recent article in the New York "World," the following appeared.—"It is an undeniable fact that the most influential business men of the world have turned their attention to mining; the richest men in the world are mining kings, many of whom have grown so from originally moderate capital."

Perhaps it cannot be literally said that we are living in a land flowing with milk and honey, but I will venture the assertion that we are living in a land which contains beneath its surface more to the square mile of that which interests capital, gives employment to the millions, and makes a country rich than any other of the same dimensions on the face of the globe.

The four and a half millions of tons of coal that have been mined in the past year are but a drop in the bucket when we consider the insignificant area from which this tonnage has been taken, as compared with an estimated area of 950 square miles, under which our best authorities—men who have devoted their lives to the study of geology and mineralogy—declare, without a doubt, that coal abounds. Within this area, it is estimated there are from forty to fifty billions of tons; there are, besides this area referred to, many hundreds of square miles of territory unproved, in which it is confidently believed coal exists in large quantities.

Of the extent of our iron ores we know that in no less than twelve counties of the eighteen in the province, large and valuable deposits exist, and we also know that shrewd capitalists, after exhaustive examinations, are spending millions of money in the province in the erection of suitable plants for the manufacture of iron and steel.

Were we to make an approximate estimate of our gold resources, based on the same character of evidence as that accepted and undisputed in reference to our coal and our iron—and why should we not ?—we must conclude that we have in gold unbounded wealth. The best authorities give the area of our gold measures at 5,000 square miles, and Mr. Fairbault demonstrates, in the most conclusive manner, that the auriferous folds in the area in which the gold veins occur, go to a depth varying from 3,000 to 17,000 feet.

Let me dwell a little upon this branch of our mining industry. It is but natural I should give it the preference. I have said we have abundant evidence of the persistence in depth of our gold-bearing veins. That statement up to within the past year or two might have been questioned: I think few to-day will be found to question the statement in view of the recent developments throughout the province, and more particularly in the districts of Brookfield, Caribou, Goldenville and Stormont.

With such evidence before us, can we for a moment doubt that at greater depths than we formerly dared to believe, we have both larger and richer deposits of ore than have been found nearer the surface ? It is true that larger capital, better equipment, and more efficient management are required to make our output of gold equal in significance to that of our coal. But while we take pleasure in speaking of the bright side of our gold mining industry, it is equally incumbent upon us to speak of some of the difficulties that confront us in the prosecution of this, the most fascinating, and sometimes at least, if not always, the most profitable of industries. While the cost of everything that enters into the prosecution of the gold mining business, including labor, fuel, timber, etc., is regulated by the supply and demand, the value of gold is fixed at a standard; it is worth no more in this century than it was in the last, while the average cost of all the requirements necessary to obtain it has increased from twenty-five to fifty per cent. in the last decade. The question naturally arises, will the yield under these conditions continue to supply the increased demand and will the industry continue in this province, as is most desirable it should? How is the yield being kept up now? It has hitherto been maintained, not so much by the discoveries of new fields, as by the improvements in the methods of mining and the wonderful inventions in mechanical devices and chemical discoveries for its recovery. It is with not a little pride that we can announce these achievements, enabling us by our ingenuity in this way to meet the increased cost of labor and supplies. While all other producers increase the price of their products to meet the demand, yet you must not forget there is a limit; we fear we have reached the minimum cost of production. Therefore, gentlemen, notwithstanding the bright side of this industry that comes from the "deeps," you must recognize the seriousness of the situation. Is not this great industry—the production of gold—paramount in importance? It is the one article that cannot be substituted. The substantiality of it gives not only impulse and pulsation to power and influence in trade and commerce, but is the bulwark of all stable governments, and the one great and indispensable article of commerce that cannot be cursed by Morganism, but the production of which may be crippled by indifferent, injudicious and parsimonious legislation.

The difficulties which the people who have invested their capital in the gold mining business are laboring under, are not of such a character that they can be remedied by acts of parliament. There are, however, in addition to these enumerated, most serious hindrances, hardships and menaces to the industry in this province, all of which can and should be remedied by legislation. I will but briefly refer to some of them by asking two questions:—

1st. With a fixed rate of value on our gold product and the ever-increasing cost on all that is required to produce it, why should we be burdened with a royalty tax, while other enterprises that can, and do, regulate the price of their product to meet the demands and exigencies, are liberally and even excessively bountied and subsidized? Please bear in mind that the consumer pays all royalties exacted; except that on gold, which is borne by the producer. If the government considers that the abolition of the royalty on the gold product would not be consistent, let it offer some other concession equal in its advantages.

2nd. If the exaction of a royalty is to be continued, under heavy penalty from the legitimate miner, demanding that he shall, under oath, register the mine, the mill and the area from which every ounce of gold he offers for sale has been taken, why is the thief and his aider aud abettor permitted to sell in open violation of the law and no effort made to collect royalty or protect the law-abiding and suffering mine owner? One of our sister British colonies, West Australia, similarly engaged in the gold mining business, recently placed upon her statute books an act remedying this pernicious evil, which exists in our own province to an alarming extent. I trust this questicn will be taken up to-day and dealt with in no uncertain manner.

Another question of extreme importance to us all, is that of technical education. In this connection you will be asked during the meeting to consider the notice of motion given by Mr. Drummond, that this society offer a scholarship in the Dalhousie School of Mining. The suggestion is both opportune and commendable, and I am sure will meet with your approbation.

This brings us to the recent move of that good old institution, Dalhousie, to establish a school of mines in connection with her other university courses. This important movement was made too late in the season for particulars to appear in this year's calendar of the university, but I assume it is to follow the lines of other institutions in devoting the first two years to chemistry, physics, mathematics, geology, mineralogy, and mechanics, and the last two years to mining and metallurgy. I notice that the faculty of science at the university includes the names of four members of this society, viz., Poole, Archibald, Gilpin and Mason, and I assume that the board of governors has consulted these gentlemen with regard to the best possible programme to offer to the public, and I feel that we can safely leave the matter in their hands, for they are men who not only know what a school of mining ought to be, but they know what the requirements of the mining and metallurgical industries of this province are, and are thus able to prepare a curriculum which will fit students to fill those requirements.

It has been said, and very truly, that the component parts necessary to make a successful mining or metallurgical engineer are nine parts of common sense and one part of scientific knowledge, the latter being absolutely useless without the former to apply at the right time and place. Thus, for instance, every chemist knew that gold would dissolve in solutions of chlorine and potassium cyanide years before Plattner and MacArthur respectively applied these solvents to the extraction of gold from its ores. And again, everyone knew that carbon, silicon and sulphur were really oxidizable substances at high temperatures many years before Bessemer devised that most beautiful of all metallurgical processes, which bears his name, in which by blowing air through molten iron, he was able not only to eliminate those substances from the metal, but to actually use them as a fuel to bring about their own combustion.

The formation of a school of mines for Nova Scotia will, if properly begun and carried out, mark an epoch in the mining industry of this country. It will supply us with young men possessing that necessary ten per cent. of scientific knowledge in their make up, and we Nova Scotians who have produced such men as Dawson, Howe, Thompson, Tupper, Grant, Fielding, and others, will feel satisfied that at least a fair proportion will possess that essential ninety per cent. of common sense. It must be borne in mind, however, that a university course in mining engineering is only intended to give the student a thorough grounding in the sciences underlying the art, which will be useful in after life if he has the aptitude of applying the knowledge at the proper time. It is not for one moment expected that a student who has graduated from Dalhousie or any other university is qualified to take a position as manager of a mine or metallurgical works at the close of his college course. He has first to doff his college clothes and don the workman's garb and go into the mine, the field, or the workshop, and there learn to apply the knowledge he has gained in his three or four years at college, and thus ultimately qualify himself for the position he is aiming for.

We are often reminded of the splendid polytechnical schools of Germany as affording the very highest class of technical education. Let me quote to you a paragraph from the report of the British royal commission on technical instruction, 1894, which is incorporated in an American circular of instruction issued from Washington, 1895:—

"Reference has already been made to the evidence that the increasing demand for men whose training has been largely practical, to fill stations of trust and responsibility, has lessened the demand for those of high but purely theoretical scientific attainments. The commission found in Germany an increase of 1000 well-trained polytechnical graduates over the demand, and they were informed that the manager of a large engineering works had been so importuned by these young men for employment that he put up a notice in his window—'No polytechnic student need apply.'"

The Baron Von Eybesfeld, Austrian minister of instruction, expresses himself thus:

"The most serious problem in education in this country is to reduce the number of theoretical engineers who, after their long course of study, find themselves not wanted, and to increase the number of men whose training and practice had been so combined that they could meet the great demand for those who can put theory and practice together.

"I cannot urge too strongly the absolute necessity of practical experience interspersed with the technical, but which must cover more than a few weeks or months before a college-bred young man can possibly become a successful manager, either as his own master or as an employee."

I wish I could feel my duty done on this occasion and leave this subject here, but I cannot. Every man in this country with his heart in the right place, must admire the noble effort of Dalhousie, an effort the necessity of which has been forced upon the governors of that institution by the great and growing need and the exceptional opportunities this province offers for such an institution. I say exceptional because almost at the very doors of an institution of this kind situated anywhere in the province, mines are in operation, giving the students opportunities not obtainable near other institutions of the kind. All this is to our advantage and in favor of Dalhousie's efforts. But can Dalhousie establish and maintain a school of mines to compare favorably with the heavily subsidized and gift-laden institutions of Kingston, Toronto and Montreal, and the many similar institutions in the United States, some of them even nearer to us than those in the upper provinces?

Can we feel assured that this province will have what she requires, and what she is entitled to, as regards a school of mines? Do we not require an institution at least equal to those near us, in order to insure the retaining of scores of young men who are hungering after opportunities for higher education, that they may be enabled to take more advanced and more responsible positions in the development of our great mineral resources?

I trust you will not misconstrue my remarks. I would not utter one word to discourage Dalhousie, but I would urge and proclaim in the most unequivocal manner that it is the duty of the government of the province to give a grant to or subsidize (term it what you choose) such an institution as a school of mines, to the extent of at least one hundred thousand dollars a year for a period of years, under such terms and conditions as will remove the possibility of any feeling savoring of the denominational. Failing to see the advisability or practicability of such a course, then let them pursue a grander and more national one in the establishment of a government school of mines, such as the income from the mines of this province warrants, and the mineral resources and developments of the country demand.

Would you ask further reason for such a demand on the government? My answer is that the phenomenal development of mining in this province has increased the revenue from royalties in the past twenty years from one hundred thousand to half a million dollars, and a more rapid increase is assured in the future; and, further, while other provinces have established, and are supporting such institutions, the province of Nova Scotia receives a revenue from royalties much greater than the revenue from the same source in all the other provinces combined.

I intended to refer to-day to the great need here of a mines and miners' registry office: and there are several other matters properly coming under the consideration of this society, relating to our mineral industry, that I also intended to refer to, but I feel that I have already drawn too heavily upon your time. Therefore, gentlemen, in closing, permit me to remind you that we mining men in this country have yet many great problems before us to be solved, which can only be done by degrees, requiring as they do, much patience, perseverance, and research, not forgetting a compound of those indispensable elements to the assurance of success—honesty, courage, and common sense. Reminding you once more of the great expansion of the industrial wealth of this little province, I feel that I am not claiming too much when I say that the question of her great probabilities becoming assured successes, depends in no little measure upon the united, sustained and strenuous efforts of this institution—the Mining Society of Nova Scotia.

A vote of thanks was unanimously adopted and tendered to President Stuart for his address.

The Treasurer's report was read and adopted.

MISCELLANEOUS BUSINESS.

H. S. POOLE.—It used to be the practice in the past of giving to each member a copy of a mining paper at the society's expense. I think it would be well to continue that practice. I therefore move that we obtain copies of each of the local journals dealing in mining matters, one on coal and one on gold ("The Maritime Mining Record" and "The Industrial Advocate") and that they be given to each member, at the cost of the society, leaving it to the council to make the best terms it can with the publishers of the different journals.

HON. S. H. HOLMES seconded the motion, which passed unanimously.

Communications were read from the "Morning Chronicle" and "The Industrial Advocate" in regard to special mining editions which they propose to publish. The communications were referred to the executive of the society.

A. McNEIL.—It would be in the interest of the society to secure an act of incorporation and have our constitution and bye-laws based thereon.

On motion, it was decided to instruct the executive to secure such act of incorporation.

The afternoon session opened at 2.30 o'clock, in the government's new building.

THEFT OF GOLD.

R. KAULBACH.—The theft of gold at the mines is a matter which has been of great importance to me, and it has been before the society in the past. We have had a great deal of difficulty during the past two years with regard to this matter at Moose River, the district in which I am operating. We undertook to bring some of the suspected persons to justice, but were unable to have them convicted, owing to the fact that we have not sufficient laws to protect us in such cases. The law, as it now is, requires mining operators, after mining and milling their ore and putting it into bullion, to make a monthly return and pay a royalty of two per cent. to the government. We are compelled as operators to do this, while on the other hand any person can mortar and sell gold without paying royalty. Last year we had a man under arrest for buying gold alleged to have been stolen, and we brought him to Halifax, but were unable to convict him owing to a defect in the law. We could not identify the gold, although we knew it came from our mine. The judge said he sympathised with us in the case, as he had other similar cases before him. Within the last fortnight I have had information that the same person has been again mortaring gold, although there has been no tributing work done in the immediate vicinity of his place. We should have a law to protect the gold mining industry of this country. It should not be necessary for us to prove where such a man obtained gold. The burden should be on him of satisfactorily explaining where he obtained it. The Hon. F. A. Laurence has promised to give us every assistance he can in the House of Assembly in getting proper legislation passed. Other mining men are here, and probably they have experienced the same difficulty we have.

PRESIDENT STUART.—We cabled some six weeks ago to Australia for a copy of their law on the subject, and we have a reply from the attorney general, saying that he had mailed a copy, but, unfortunately, it has not yet reached us.

F. P. RONNAN.—In the last issue of my paper, the "Industrial Advocate," I had an article on this question, and probably it would interest the members if the secretary read it.

SECRETARY WYLDE then read the article, as follows:

"From time to time the question of protecting mine owners from the dishonesty of their workmen crops up in Nova Scotia, and the Mining Society has grappled with the subject on many occasions without any great measure of success. All countries possessing free-gold deposits are liable to the same difficulty in the detection and punishment of thieves who contribute so much to the depreciation of values in an ordinary free-milling mine where the gold is coarse and easily portable. The main obstacle in the past has been the identification of stolen quartz, and the following reference from an Australian paper of recent date might suggest some action in Nova Scotia that would be sufficient to overcome the present disabilities:—

"'A most necessary and long-looked-for amendment is provided in the Police Amendment Bill recently introduced into the Westralian legislative assembly in regard to gold stealing. The difficulty at the present time is that if a mine owner brings a charge of gold stealing against a person, he is asked to identify the gold itself—an almost impossible thing to do. The advantage of the provision in the present measure is that a person has merely to be proved to be in possession of the gold which is reasonably supposed to have been stolen. The attorney-general, in moving the second reading of the bill, said:—The clauses appeared to be rendered necessary in view of the grave fact that gold stealing was rampant on the golden belt. Efforts have been made time after time to check the continued growth of these robberies, but without success. The companies have employed detectives, who have brought prosecutions and used their utmost endeavors to enforce the existing law. They have, however, failed, and the evil is of larger proportions to-day than ever before. There is an urgent need for the amendment of the law.

It is provided in the new bill that any person charged with having on his person or cart or vehicle, or in his possession or on premises of which he is the tenant or occupier, any gold (meaning gold bullion, retorted gold, gold ores, alluvial gold, gold amalgam, gold alloys, zinc precipitates, slag, concentrates, tailings, residues and unwrought gold in any form), reasonably suspected of being stolen or unlawfully obtained, and who does not prove that he came by it lawfully, will be liable to a fine of not exceeding £50, or a term of imprisonment not exceeding six months. The question of accessories is also dealt with. The amending bill will be highly embarrassing to the receivers of stolen gold, but will not in any way interfere with legitimate dealers. First catch the thief, and the remainder is an easy matter for disposal.'

"This is good law that the burden of proving lawful possession should rest upon the suspected person. It is, of course, somewhat in conflict with the old English maxim of presuming a man innocent until adjudged guilty, but the circumstances call for some such departure."

PRESIDENT STUART.—The Nova Scotian government makes laws dealing with the illicit sale of intoxicating liquors, and also with the protection of game, and it seems to me that the passing of an act to prevent the theft of gold would come under its jurisdiction. I think the best way, perhaps, to deal with this matter is to pass a resolution asking the provincial government to take the matter up, and if it is not within its jurisdiction, to ask the Dominion government for power to deal with it. That might be done by resolution, as I have suggested, or a committee might be appointed to wait on the government and place the matter before it. I do not see why the local government should not interest itself in this matter; in fact I have every reason to think that it will, if the suggestion comes from us.

HON. S. H. HOLMES.—It appears to me that it would be best to ask assistance from the Dominion government directly. In order to give the local legislature power to deal with such a measure, you would have to have the British North America act amended.

H. S. POOLE.—In 1870 there was an act such as we require on the Dominion statute book.

F. P. RONNAN.—Why not have concerted action also by the various mining societies in other parts of the Dominion? I think the advantages of such legislation are so apparent that there should be no difficulty in getting other societies to help us.

H. S. POOLE.—Most of the gold in the west is not obtained in the same way that it is in Nova Scotia, and so the matter does not come home to the western people as forcibly as it does to us.

F. P. RONNAN.—But they would recognise the good principle of it.

R. KAULBACH.—I move that this matter be left to the council of the society to deal with it as it may deem necessary.

HON. S. H. HOLMES seconded the motion which passed unanimously.

(Further discussion on the subject of theft of gold, will be found on page 30.)

MINING SOCIETY SCHOLARSHIP AND TECHNICAL EDUCATION.

HON. R. DRUMMOND.—I move that this society endow a scholarship in the mining school of the University of Dalhousie College. We profess to wish to see technical education carried out, and we have to show our sympathy in a practical manner. At this time, this is the only channel in which we can exhibit our sympathy. We should show a good example to the government. The details could be left to the executive of the society.

D. McDONALD.—I would like to ask Mr. Drummond if the scholarship would only be open to coal-mine managers? Should not gold-mine managers have the benefits of this scholarship as well?

HON. R. DRUMMOND.—There are no schools now established in this country in connection with gold mining, and under these circumstances how could you select fit and proper candidates? There are now in existence coal-mining schools, and the scholarship should be open to the best graduates of these schools. I would be perfectly willing to extend the privilige to the gold-mining men if it can be pointed out how it could be done

D. McDONALD.—I think that both these classes of mining men should have equal advantages and opportunities. If a gold-mining company organizes to-day, it has to go out of the country for a first-class man to take charge of its mine. We should encourage the education of gold-mining men so that they could take charge of a mine when called upon to do so. If we are going in for technical education, I believe our gold miners should be included in the list of those who can take advantage of any scholarship offered.

F. P. RONNAN.—Why not establish a scholarship to be open to all young men? I do not see why it should be restricted to the coal-mining men. The coal-mining industry has been already assisted by the local mining schools.

Hon. R. Drummond.—I would be very sorry indeed to have made the motion if I thought there would be any clashing of interest. If the gold-mining men can put us in the way of endowing a scholarship for gold-miners we will be most happy to entertain it. Is it fair that the coal-miner should have to wait for assistance until the gold-miners are so situated that they can take advantage of it? We can do something now to show our sympathy for technical education, and that we can do by endowing a scholarship.

D. McDonald.—Hon. Mr. Drummond must not think that I am trying to throw cold water on this proposal. I want to do everything that lies in my power to aid men to get a mining education. But why should we not have our young men who are growing up around our gold mines, examined in the mining schools, and why should they not have certificates issued them? That is all we ask. We have young men in our gold mines aspiring to higher positions, but they have never received any encouragement. I do not see why our young gold miners could not be examined in order to qualify as underground managers and managers. Why can we not get our gold mines on the same footing as the coal mines?

A. McNeil.—Since this matter of technical education has come up in the society, I have taken a good deal of interest in it. You know we have consistently advocated a particular policy. That policy is, that the government should appoint a commission of suitable men to enquire into the experiences of other countries, and also into the condition of education in this province. One of the leading conditions of a successful system of technical education is that the basis be a sound one—that the general system of education which forms the basis of higher technical education should be suitable. This commission should enquire into the system most suitable to our own province. We carried that policy before two large committees of the house of assembly last session, and the recommendation we made on behalf of this society was unanimously adopted by those committees, and the recommendation of those committees was unanimously adopted by the house of assembly. So it is the government that has to decide upon this whole question to-day. Now the gentleman who made this motion is impatient, and very naturally impatient, that something should be done in the meantime. He is perhaps in closer touch with the coal-mining industry than any other man in this province. He knows better than any other man in the province the great need for well-trained men, and he would like to see something done at once towards filling that demand. That is a most natural and laudable desire. But their is just one thing to guard against, and that is, doing anything at present that would interfere with securing what is best for the province. But I am not quite clear whether it is intended that the scholarship shall be a lump sum for one year or not.

HON. R. DRUMMOND.—A lump sum for one year.

A. MCNEIL.—If that is the case, I do not think very much would be accomplished, especially as it is only for one year. To be very beneficial it would have to be continued for a period of years. The gold-mining men of this province say that in order to get men to take the higher positions in the auriferous mines in the country, they are obliged to-day to go outside of the province for them. The gold-mining territory of this province embraces an area of 5,000 miles or about one-fourth the surface of the province. We have the highest authority in the Dominion saying that the gold-bearing measures extend to a great depth, and this has been demonstrated to us by actual facts. I say that we are not in earnest if we speak of the instruction we require in a half-hearted spirit or speak of the institution that we need as one that will cost little money. We must have in view an institution that will take its place with the best institutions in the world. I do not care whether we get it in ten years or twenty years, if we do not start with true ideals, if we do not start with a clear perception of what is needed, we will never reach the right result. And any proposition of giving a scholarship to an institution which cannot achieve that result, will be useless. I can see that no single body, outside of the government, can hope to get the money that we require to build and equip such an institution. We need information on this subject, and we do not wish to proceed before we have that information. We desire the government to get that information. Indeed we should insist that the government should do so, and in doing so, the government should take advantage of the experience of other countries in this connection. They have had experience in the United States and in Germany with respect to this subject, and it is the duty of our government to get the benefit of that experience.

J. G. McNulty.—I am a graduate of a school of mines at Freiberg, Germany. There we had a school of mines not only for educating mining engineers, but also for educating mine foremen. What we, to-day, should do in this province, is to educate our foremen. I, as an American student, had to pay $25 a year at Freiberg. A native student paid nothing. A state student was given means from the government to carry him through his course. This school at Freiberg is about two hundred years old. There were about three hundred students attending it at one time—twenty-five of whom were from the United States. It is entirely run by the Kingdom of Saxony.

Professor E. MacKay.—The question that is now under discussion, namely, technical education in mining, is one that is of much interest. It is to my mind the most important educational question that the province has to solve and one which must be solved in some way in the near future. Two alternatives seem to be under discussion at the present time, and they do not appear to be wholly inconsistent. I quite agree with Mr. McNeil that we should profit by the experience of other countries, and particularly we may look with advantage to other institutions in Canada itself. Two or three of these institutions have attained a certain magnitude and have done work that is of great value. It is quite possible to place before ourselves an ideal, and it is quite right that we should do so. We can only do the best work when we have a lofty ideal. But shall we do nothing because the ideal we put before ourselves is unattainable in the near future? What we should do, is to work in the direction of an ideal, and to begin doing something at the present time. Let us start on the right road directed towards that ideal. Because we cannot get two millions of dollars to-morrow, is not a reason for inactivity; let us be careful that we are directing our efforts towards that ideal which all of us have in view. If we look at the history of the institutions in Canada at the present time, if we look at their origin, shall we find that that has been the principle which has guided them? Take the mining department of McGill University. For two or three years it did its work on a relatively small scale, but it went on in the right direction. Exactly the same thing is true of the Kingston school of mines. Professor Goodwin, during his last visit to Halifax, on a public occasion reminded those who heard him that it was doing extremely valuable work. Now at this school of mines a very small part only of $2,000,000 has been spent; but ultimately I hope that amount will be spent. The same thing is true of almost any other institution. It is possible to direct the work of an institution in a certain direction and to do admirable work, and to do work that needs doing and which would be of permanent value, and yet not at a cost of $2,000,000. It is necessary to keep in view what we might do with such an amount. There is not, of course, an institution in Canada at the present time that comes anywhere near the ideal institution. I do not think there is one in America at the present day that comes up to the ideal institution, but there are some which approach it.

What we should do to-day, in my opinion, is not to defer the matter until we can spring into the arena with a fully equipped institution, ready to do everything. If it were possible to have $2,000,000 given us at the present time by some magical benefactor, it is very likely that at the outset a great many mistakes would be made. The needs of Nova Scotia are not identical with the needs of any other country. We have to find out by experience what particular kind of work is best adapted to the needs of this province. I think, therefore, the way to reach our institution is to begin with the resources at our command, keeping, however, before us the ideals of which Mr. McNeil has spoken.

Such an institution should have the capacity of entering upon and maintaining investigations as to the proper treatment of the various kinds of gold ores of this province. It should be able to inaugurate and complete such investigations. In fact, it should be the repository of all sorts of knowledge to be gained by investigations of mining conditions in Nova Scotia. Now, investigations of this sort are very expensive, and require an extensive plant. But investigations can be carried on of very great value to the province without a fully equipped plant. The necessary plant will not cost many thousand dollars—it may not be an ideal plant, but it will be in the direction of an ideal plant. The Toronto School of Mines, which is doing, I understand, good work, started in a comparatively modest way. What is essential is, that the proper standard should be kept in view, and that the proper ideals should also be kept in view—and in so far as our means allow us that should be carried out. Because we cannot get our two millions of dollars at first, seems to be absolutely no reason why we should not go on in the direction of an ideal institution. There is much to be done before we could spend that sum to advantage.

There has been made by Dalhousie College, in Halifax, a resolute attempt to solve this important problem of technical education. It is not three quarters of a year ago since that attempt was publicly inaugurated. It has in the meantime made progress. Classes have been organized, but all will not be started until next year. The appointment to the chair of mining and metallurgy will be made during the next few months. Ideals will be kept in mind just as in the starting of the Massachusetts Institute of Technology, the name of which institution everybody now respects. It started in a comparatively modest way. So did the Columbia School of Mines. There is no such thing as a thoroughly equipped, fully endowed institution, capable of doing the work of the province, springing immediately into existence. The thing is impossible. Even if we had the money, we have yet to acquire the experience as to what can be done economically.

We shall best be forwarding the interests of mining—of that particular branch of higher technical education in this province, if we do the very best we can with something less than the vast amount of money that has been mentioned. We should try to do the best we can with our very limited means. The most important question before us at the present time is, how shall we best proceed in the public interest of Nova Scotia? To my mind it is better to acquire some little experience and build up, as has been done in other institutions, either directly under government control or otherwise—build up an institution gradually, and acquire experience as we go along.

Professor D. A. Murray.—I agree with Professor MacKay that in Nova Scotia, a comparatively poor province, we have not money to expend in large amounts. We will have to build gradually. In a society like this, particularly interested in one branch of technical education, we will have to consider that first of all. The main question was touched upon by the Hon. Mr. Drummond—all that a society like this can do is to encourage the idea of having a technical school. If this society should devise any way of bringing technical education before the people and before the government, it would be doing a very good thing for the whole province. As I am not a member of this society, I shall not suggest a method. If a school were only started in a small way, it would do a great deal of good for the province. What we want here is to have public opinion educated, and I think the government is only waiting until public opinion is educated.

H. S. Poole.—We discussed this question last year. After hearing the matter again discussed, I think it would be better to fall back upon our former proposition of obtaining a commission. I will, therefore, second the proposal of Mr. McNeil, that we should again press for a commission to enquire fully into the subject.

Hon. R. Drummond.—That does not interfere with my resolution relative to a scholarship.

H. S. Poole.—Your resolution was not seconded. It was not clear enough to generally satisfy our members. If you draw up your resolution so that the scholarship would be open to all mining men, irrespective of gold, coal or iron, then there would not be the least opposition to it. No favouritism should be shown. Perhaps you would test the sincerity of the society by letting it select one man out of three or four candidates?

Hon. R. Drummond.—That is the very thing I wish to avoid. The man who had the greatest influence would get the scholarship. If the gold-mining men can pick out a deserving young man he could be sent to Dalhousie at the society's expense.

H. S. Poole.—I can pick out one.

J. G. McNulty.—I can name two, assistants of mine at Waverley.

Hon. R. Drummond.—The reason I mentioned coal miners was because I did not see how we could get any other men.

H. S. POOLE.—The motion of Mr. McNeil was: Resolved that the government be asked to appoint a commission composed of able, independent and impartial men who shall enquire fully into the subject of technical education and the best primary work as a prepartion therefor as now carried on in other countries and the method best suited to the needs of Nova Scotia.

The motion passed unanimously.

HON. S. H. HOLMES.—I do not think the society is fairly chargeable with the accusation that it is not in earnest, that it is not desirous of advancing technical education, and I move that the council of the society be authorized to endow a scholarship in any institution it may think proper, for the purpose of sending a scholar to the school for one year if it thinks it advisable, the council to have the selection of the person who is to receive the benefit of the scholarship. If the society agrees to that, it will show that it is desirous of assisting any man we may desire to send there. Who shall examine that man, may be left to the institution to which he may be seeking admission. The society that provides the money should have some voice in the approval of the candidate.

C. C. STARR seconded Mr. Holmes' motion which passed unanimously.

PAPERS READ.

The following papers were read:—

On the Corrosive Action of Boiler Feed Waters, by F. H. Mason. (Reproduced elsewhere.)

Some Aspects of Technical Education, by Prof. T. B. Kidner. (Reproduced elsewhere.)

Observations on Gold Milling, by J. G. McNulty. (Reproduced elsewhere.)

On the Thawing of Dynamite, by J. G. McNulty.

The Modern Method of Coal Washing, by C. A. Meissner. (Reproduced elsewhere.)

Notes on the History of Manganese Mining in Nova Scotia, by W. F. Jennison. (Reproduced elsewhere.)

Stamp Milling Practice in Nova Scotia, by M. R. O'Shaughnessy. (Reproduced elsewhere.)

MISCELLANEOUS BUSINESS.

A. McNeil.—In order that this society should show its appreciation of the work done by Professor Kidner in the field of manual training in this province, I move that he be made an honorary member of the society.

M. R. Morrow seconded the motion which passed.

H. S. Poole.—I wish to call the attention of the society to the loss of one of our members while we have been in session. I would move that a letter of condolence be sent to the family of our late fellow member, John George Rutherford, whose untimely death has been reported. Associated as I was with him for some fourteen years, I would like to record his many excellent qualities, the care he gave to his work, and the respect he won from all classes with which he had to deal. His loss will be felt by the coal interests of the province.

The motion passed unanimously.

H. S. Poole.—I move that a list be prepared of our practical miners and that a record be made of their experiences. I make this motion because not long ago my attention was called to the lack of a list that might be available for filling mining positions throughout the province.

R. Kaulbach.—I think it very important that we should have a list of men competent to take positions. Sometimes we are at a loss to find a man, and it is only after much enquiry we are able to get one. I endorse the suggestion very heartily and second the motion.

The motion passed unanimously.

ELECTION OF OFFICERS.

Officers for the ensuing year (1903-4) were elected as follows:—

President—Cornelius Shields, Sydney. *Vice Presidents*—Alexander McNeil, Halifax; C. A. Meissner, Sydney; Clarence H. Dimock, Windsor. *Council*—Alexander Dick, Charles J. Coll, Charles Archibald, David Baker, J. H. Austen Hon. S. H. Holmes, F. H. Mason, A. A. Hayward, C. N. Crowe. *Secretary-Treasurer*—H. M. Wylde, Halifax. *Auditors*—C. C. Starr, R. H. Brown.

HON. R. DRUMMOND.—I move that the next half-yearly meeting of the society be held in Sydney.

A. MCNEIL seconded the motion which passed unanimously.

The meeting adjourned till the following morning.

The meeting opened on Friday, February 20th, at 10 o'clock, a. m., in the government's new building, with ex-President Stuart in the chair.

REPORT OF COMMITTEE ON ASSAY OFFICE, TECHNICAL EDUCATION, DEEP MINING, &c.

HON. R. DRUMMOND.—The committee on technical education and other matters, appointed at our last meeting, waited on the government and had an hour's conversation. We were obliged to the government for the time it spent with us, considering it was the day previous to the opening of the legislature.

One of the matters brought to the notice of the government was the establishment of an assay office. We were told that the subject was still under consideration. I am here to-day to give my own private opinion, as well as the opinion of the committee, and I think that that is a diplomatic way of putting off the committee. I do not believe that the government realizes the seriousness of our request, and some measures should be taken to impress upon it that this society is really desirous that the government should establish an assay office.

The committee then brought up the matter of technical education. Premier Murray said he would have something further to say when Professor Kidner had furnished him with a report he had asked him for.

The subject of encouragement to deep mining was then taken up and was discussed with the government. The government said that encouragement to the gold mining industry was under consideration. That subject we can now eliminate from our list of grievances, as I noticed that the Lieutenant-Governor in his speech from the throne yesterday, said that particular attention would be devoted to gold mining, so that those engaged in that branch of industry may share more largely in the general activity and prosperity.

We then brought up the request for a better government mines report. But in its reply I think the government took a wise stand. It said it really desires to know what the society want. In conversation with Dr. E. Gilpin, inspector of mines, some time previously, he asked me, What does the Mining Society want? I replied, Perhaps some pictures, such as are published in the Canadian reports,—but I really was not in favor of it myself. Mr. Poole expressed his opinion that what was required was improved editing. If that was all we wanted, we should have stated so when the matter was brought up at first in this society. But I think you want more than that. The government said to us fairly, Put down in writing what you want in reference to the department of mines report and we will carry out your wishes. Nothing possibly can be fairer than that. I think the government is right in that respect and the society has been perhaps a little remiss.

The matter of improvement in surface mine plans was then spoken of. The Commissioner of Works and Mines explained that he was engaged in making new plans. He incidentally remarked that it would require a resurvey of the province, because some of the surveyors of that department had not taken notice of particular landmarks in their surveys, their maps being indefinite in that respect.

As to the matter of the deputy inspectors having a certificate, the government agreed with us.

The committee wants from the society this morning instructions in writing as to what is desired in regard to the department of mines reports. We have to go to the government with something in writing, so that it can definitely understand what we want.

CHAIRMAN STUART.—I think it would be well to define more fully what we desire, and reinstruct the committee so that it can go before the government with something definite.

HON. R. DRUMMOND.—As it might take too long for every member to express his views on the subject, I suggest that you appoint a committee with power to receive suggestions from any member of the society and then the committee could draw up a report embodying the views of the members.

THEFT OF GOLD.*

CHAIRMAN STUART.—I would like to impress upon the committee the great necessity of legislation on the question of gold stealing. It is one of the most important matters for the gold-mining industry. You will be surprised perhaps when I tell you that a large percentage of the Armenian peddlers who are going about the country, and the country is full of them, are offering gold in all forms for sale. In one week three Armenian peddlers offered a jeweller in Truro three different lots of gold in a retorted form. These were in large quantities too. I was sent for by the jeweller but had to tell him I was helpless. The only thing I could do was to notify all the managers of the mines in that section of the country. Although I have communicated with all the managers of gold mines in the eastern counties, nevertheless the peddlers are still offering gold for sale. These peddlers came from the Stormont district.

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* See also p. 14.

HON. R. DRUMMOND.—The Nova Scotian government can pass an act whereby no man can mill quartz to obtain gold without a license, then it is surely a simple matter for the government to attach a clause, whereby no man who has not a mill license shall sell unwrought gold in any form—quartz, gold or amalgam—without a license, and if he should do so he could be brought before a magistrate.

J. G. HUDSON.—If a man applies for a mill license, he has to get bondsmen; yet these Armenian pedlars can obtain this gold and go into the open market and sell it.

R. KAULBACH.—It seems to me there is a remarkable clause in the "mines act." The act defines what the conditions are with respect to mine owners and mill operators—that they must conform to certain things and pay royalty within a certain number of days; but at the foot of the act, it says, "except gold mortared by hand." That is where the whole trouble comes in. Any man can take gold into Halifax and sell it, and the mines department cannot molest him if it has been mortared by hand. The man I have referred to had all the appliances for mortaring gold. This man can bring it into Halifax and sell it without prohibition, the same as a bushel of wheat or oats. The government should amend the act, and I believe such an amendment would help the gold-mining industry of this country.

A. MCNEIL.—As a member of the executive of this society, I may tell you what our policy may likely be on this particular question. With respect to the local legislature dealing with the subject of gold theft, there is a question of jurisdiction. For instance, the proposal of Hon. Mr. Drummond might or might not be considered within the legislative authority of the local parliament. There is no question of jurisdiction if you create a new crime or if you attempt to frame something with regard to criminal evidence, that must be dealt with by the Dominion parliament. There being a doubt, our executive would refer it to the Commissioner of Mines, who is one of our best lawyers, and also furnish him with a copy of the Westralian act, and ask him for similar legislation to be passed by the Dominion parliament if it be found that that is the right body to deal with it.

UNDERGROUND PLANS OF MINES.

CHAIRMAN STUART.—I would urge in the strongest possible way that the government make it compulsory for underground plans of gold mines to be kept. Of course it is impossible to get underground plans of old works, but it could be done with respect to future work. It is the simplest thing in the world to make these plans. It is merely a matter of measurement underground.

R. KAULBACH.—It is the law now that such plans be kept.

CHAIRMAN STUART.—Yes, but it is not enforced.

MINES REPORTS.

CHAIRMAN STUART.—In regard to our request for an improved report of the department of mines of this province, I may say that when we before met the Commissioner of Mines, we simply placed in his hands a copy of the report of the Commissioner of Mines of British Columbia, which is very full. Of course it is true that there are a good many cuts of mines and scenery in it, and I think we said to the Commissioner that we had no objection whatever to eliminating anything of that kind, although I believe cuts of a number of important mines are attractive and interesting, however, there is no particular value in them. What we want is more extended reports. Those now issued are very meagre, and have been up to the present time, except when Mr. Poole was Inspector of Mines, at which time they were very good indeed, and much more extensive. His reports were splendidly prepared, although he did not have the opportunity that we now have. There are now so many grammatical and typographical errors, etc., that they leave a bad impression. You would be astonished at the number of enquiries from abroad for our reports. In fact, it is the only thing that foreigners have to depend on as being absolutely reliable.

A. McNeil.—Since I came into this society, there was nothing in its happenings that raised so much wrath and brought forth such fierce discussion as these mine reports. It was kept up in season and out of season, and yet the mines report came out year after year in the same form, with the same blue-book look on its face, and with the same thing inside. It seemed that the gentlemen who were making these complaints were serious, and it was decided to set them to work. A year or two ago a motion was made that everyone who took part in this agitation should be put on a committee, and that they should co-operate with the department of mines in bringing out an elaborate report that should contain all the information that they demanded. They were men of such ability, men of such information, men of such influence, entrusted with the discharge of these duties, that when the next mines report should come out we fully expected it to be such a report as would commend itself to the attention of the whole mining world. What do you suppose happened to the committee? It never met! Now, that is not the way to bring about reforms. We are engaged in a serious business. When you take up such a question as this, you should take it up seriously and mean what you are talking about. If we are going to do anything, let us be in earnest about it. We have had a perfectly courteous and perfectly open invitation from the Commissioner of Mines to define what we want. The Commissioner is a man who I believe is gradually taking hold of the problems of the mining industry. If he were paid an adequate salary on which he could live by the mines department, he would do more towards carrying out the interests we have at heart. I do not see how the mining industry of this province can expect a man who was earning perhaps two or three times the salary paid the Commissioner of Mines, to take a position and give his whole time and attention to it for three thousand dollars a year. And if we are going on in this niggardly and half-hearted way, we have a very little idea of things in this country. It would take the whole time and attention of the best man we ever had to solve these questions—and yet we expect the Commissioner to get up an elaborate book and deal with all other questions. We must bear in mind that it takes the best men in the world to compile works of valuable information. Here is a work we are calling upon the Commissioner to compile, and yet we only pay him for half his time. You cannot expect him to do it.

CHAIRMAN STUART.—You must not charge us with the parsimonious part of it.

A. MCNEIL.—I do. We are all shareholders of the mining industry of this country. You cannot expect a government to be anything except what the people make it. I am never going to rail at the government. We can do what we like in this province; we can make it or unmake it, and I hope we will make it. That is the situation in regard to these mines reports. If we have men in this society who know what a good mines report ought to be, let them speak out.

If there is anybody in this society willing to take up this huge work of approaching the Commissioner of Mines and telling him what should go in the book, let him come forward and do it. There are some members who can give him the information. We will turn out the best mines report in the Dominion and one of the best in the world if the right men go to work. If we appoint men on a committee to assist the government in the prepartion of these reports, by all means let them go to work with industry and enthusiam. I would not copy British Columbia. Some of the biggest "fake" business in the world came from that province. The whole mining industry was so inflated, that for a few years it almost killed the immense mining resources of that province. We never want to see such a state of affairs in Nova Scotia.

HON. R. DRUMMOND.—I am glad to hear Mr. McNeil's remarks. A number of years ago I was upbraiding at Premier Murray on these matters. The highest paid man in the government should be the Commissioner of Works and Mines. The best man should go there and get a good salary. No matter how good a man the Hon. Mr. Drysdale is, he should not be in the office unless he devote his whole time to it. And that is why I say he should have a salary to keep him, independent of his legal business. But to return to the department's reports. I had the privilege yesterday of seeing one of the reports. I have some idea of the printing business and it would drive me wild to have to correct one of these reports. There were numerous typographical and other errors in one page. What I suggested to Dr. Gilpin was this, adopt the Cumberland Railway and Coal Company's excellent system for obtaining their reports. The inspector should be given printed questions, monthly, to answer. Whatever information the department wants should be put in these printed forms and the inspectors should answer them. They should not write out a report, but merely answer the questions. I would rather receive hints from correspondents than correct what they write. It would be better for Dr. Gilpin to have these replies to the department's questions and that he should write the report therefrom, for the inspectors are not competent to write departmental reports. It was not for that object they were first appointed. We are ready now for a better class of inspectors. We have had good inspectors, but we had no one in touch with the men, and the latter were afraid to report to the inspector for fear they should be victimized. There has been an educating influence at work for the past eighteen years, and men and managers are much better now.

CHAIRMAN STUART.—I am quite in accord with many of the remarks made by Mr. McNeil and by the Hon. Mr. Drummond. There have been errors in these reports that have been simply unpardonable. Take for instance the report for 1901. The largest district. that has produced three times as much gold as any other district in the province, is not mentioned at all, namely, Goldenville, and the two mines that are mentioned in Goldenville are credited to Harrigan Cove. Such errors are really inexcusable.

HON. R. DRUMMOND.—I would like to know from Mr. John Johnston, if the table of amount of air circulating in the coal mines each month, on page 17 of the report of the mines department for 1901, is sufficient.

J. JOHNSTON.—My own personal opinion is that it is not full enough. The reports of the mines departments of Illinois and Pennsylvania are excellent, and we would like to see ours modelled on the same lines. With respect to ventilation, a colliery at Sydney Mines, in the month of January, might have registered 150,000 to 200,000 feet of air. But people want to know something more than that. They want to know what that air is for. They know it is for ventilation. If an explosion takes place, they turn to the tables to see how much air has been furnished—but they also want to know how many men, how many boys, and how many horses have been consuming the air. Ventilation is furnished for the purpose of enabling the miners to extract from the earth its mineral resources. Manual and animal labor must be protected by ventilation. The table should give the number of men and boys and horses that breathe this air, otherwise it is not complete. Then, again, the tables are not in a convenient place in the report. The amount of coal produced per man, per day, is not correct. The colliery that produces five tons of coal per man per day, need not complain of idleness nor drunkeness. There are few collieries that are producing five tons per man per day. It is not fair that the honest working man should be put down against a man who does not work half his time.

HON. R. DRUMMOND.—Look at page 29, where is given a table of dates of inspecting visits to mines.

J. JOHNSTON.—That is only information for the department. The inspector shows that he has made a visit to such a mine on such a date. That is only put there as a matter of convenience to the government.

R. H. BROWN.—I endorse everything that Mr. Johnson states. Ventilation is one of the most important things required in a colliery. At Sydney Mines we had an hourly record of every cubic foot of air that went into the mine. In England they say there should be five hundred feet of air per minute for each man. If an explosion occurs, the figures can be produced showing the number of men and the quantity of air they had to breathe. I think it is well that these records should be kept nd that they should be published. I believe that the people take an interest in these things. Those tables could be extended ery much. For instance, we should be told as regards each olliery, whether safety lamps or naked lamps are used, and he maker's name should also be furnished. At Sydney Mines we introduced the English Marsaut lamp. At the time it was the best that could be obtained. Since then, possibly there may be something better. And even the kind of the oil used might be referred to. The oil we found best was procured in England.

J. JOHNSTON.—A great deal of credit is due to Mr. Brown and his company. He placed on his ventilating fan a locked pressure gauge, and any man could go into the fan house and see the pressure on this gauge at any time, and it could not possibly be tampered with except by the man who held the key. This may seem a trifling matter, but it is important. The mines act says there must be "adequate ventilation," but the word "adequate" covers a good deal.

On motion of A. MCNEIL, seconded by R. H. BROWN, Messrs. Stuart, Drummond and Poole were appointed a committee to act in conjunction with the Commissioner of Mines in getting out next year's report of the mines department.

On motion, Messrs. McNeil, Drummond and Poole were appointed a committee to take up the matter of technical education, the establishment of an assay office, and new mining plans, and to interview the government thereon.

MISCELLANEOUS BUSINESS.

HON. R. DRUMMOND.—I would like to refer to a matter that has been appearing in the Upper Provinces papers. It seems that we have a man in Canada who is far above anything that we have had in this province, and as we are more particularly interested in mining, perhaps with the exception of British Columbia, than any other province in the Dominion, I think we should claim part of the services of this expert. In the *Toronto Globe* and other papers, a number of reports of inspectors of mines point out

Dr. Haanel as a Canadian mining expert. There are a good many things we would like to know in Nova Scotia. I would like to know a great deal about our iron ore deposits. I move this resolution :—

"Resolved that the Minister of the Interior be respectfully requested to send to Nova Scotia at the earliest convenience, Dr. Haanel, the Superintendent of Mines, to examine and report on our mining practices, with a view to our profitably applying the ability and experience to which our attention has been called in the *Toronto Globe* and other newspapers by delineation and by description of the services rendered in the west of 'Canada's Mining Expert.'"

A. McNEIL seconded the motion which passed unanimously.

HON. R. DRUMMOND.—I move a vote of thanks to the retiring president, Mr. George W. Stuart, for the excellent manner in which he has filled the duties of his office.

A. McNEIL.—I wish to second the motion. When the history of the Mining Society of Nova Scotia comes to be written from its earliest period down to the time when the present incumbent took the chair, the work of that gentleman will be more fully appreciated. During the difficult and at times dangerous period through which the Mining Society has gone during the past three years, a period starting from almost the total collapse of the society up to now when it is emerging into a position of great influence and great power and great possibilities, we have had the untiring hand, the unselfish assistance of the gentleman who is just leaving the chair. That sort of voluntary work on behalf of one's own country, that sort of work which is given without fee, is a kind of effort which we as citizens should emulate, acknowledge and appreciate.

The motion passed unanimously.

On motion the following gentlemen were appointed a committee to arrange about the details of the meeting of the society in Sydney during the coming summer: Alexander McNeil, chairman, T. J. Brown, Alexander Dick, J. L. Brass, Hon. R. Drummond, J. P. Edwards, James T. Burchill, George Stuart, W. L. Libbey, Joseph Quigley, Geoffry Morrow and H. M. Wylde.

HON. R. DRUMMOND.—I move that the executive of this society be empowered to enroll members at any time previous to the next half-yearly meeting, and that in the revision of the by-laws the enrollment of members be taken into consideration

D. MCDONALD seconded the motion which passed unanimously.

ROYALTY ON IRON.

W. F. JENNISON.—I do not think it fair that an iron ore of 40 per cent. should pay the same royalty as one of 60 per cent. If 60 per cent. iron ore pays only 5 cents, the 40 per cent. ore is worth nothing as regards royalty. When you increase the impurities in iron ore, you not only lose the percentage of iron but have to handle the same quantity and use more fuel and flux, so that the cost is greatly added to. I also advocated something being done in the near future to test the iron deposits of the province.

CHAIRMAN STUART.—It is a very important question paying royalty on iron ore notwithstanding the unit. With respect to gold, two per cent. is paid on every dollar on a valuation of $19 an ounce. As a matter of fact it is not infrequent to have gold bullion that will only run from $14 to $17 an ounce. The gold in such cases may be obtained from close scrapings. I remember one occasion on which I had a bar of gold of 749 ounces that only gave $17 an ounce—the rest was silver and some copper, and yet I had to pay the gold royalty on a valuation of $19. I think it is quite a hardship in many cases.

W. F. JENNISON.—There is another matter I would like to refer to. Every right of search should be staked, and the corner stakes should be described in the application, so that the public could know exactly the ground taken up. In Newfoundland you have to stake out your property. In that colony you have to use a square stake four inches square and put in the ground 18 inches, or build a cairn around it 18 inches high, and have the post properly lettered.

The meeting adjourned.

ANNUAL DINNER.

The annual dinner of the society took place at the Halifax Hotel, on Thursday evening, February 19th.

MEETING, OCTOBER, 1903.

The semi-annual meeting of the society was held at the Provincial Science Library, Halifax, on Tuesday, the 27th October, 1903. The Vice-President, Alexander McNeil, took the chair at 11 a.m.

There were present—Alex. McNeil, director Port Hood Coal Co., Halifax; Alex. Dick, general sales agent Dominion Coal Co., Sydney; James Baid, manager Maritime Coal Co., Maccan; A. A. Hayward, Waverley; George W. Stuart, manager Nova Scotia and Mexican Mining Co., Goldenville; Hugh Fletcher, Geological Survey of Canada, Ottawa; C. N. Crowe, manager Dominion Antimony Co., West Gore; F. H. Mason, assayist, Halifax; Francis Burrows, manager Cumberland Coal and Railway Co.; G. L. Burritt, Halifax; G. J. Partington, manager Dolliver Mountain Mining and Milling Co., Isaac's Harbor; Harry Piers, curator Provincial Museum, Halifax; Dr. H. S. Poole, Halifax; R. A. C. McNally, Halifax; Charles Starr, Halifax; J. H. Austin, Halifax; John Rutherford, Halifax; F. P. Ronnan, editor "Industrial Advocate," Halifax; W. C. Milner, Halifax; Prof. Ernest Haycock, Acadia College, Wolfville; H. M. Wylde, Halifax; J. M. Geldert, Halifax; G. E. Francklyn, Halifax; B. C. Wilson, Waverley; D. C. Hood, Waverley; J. C. Taylor, New Glasgow; Hon. S. H. Holmes, Halifax; J. A. Johnson, Halifax; W. B. Ross, Halifax; F. W. Hanright, Halifax; T. R. Gue, Halifax; and M. R. Morrow, Halifax.

The minutes of the last meeting were read and confirmed.

The following candidates were elected members:—Francis Burrows, manager Joggins Mines, Joggins; Professor F. H. Sexton, Dalhousie College, Halifax.

(The names of members elected by the council since the last meeting, will be found on page 44.)

VICE-PRESIDENT'S ADDRESS.

VICE-PRESIDENT A. MCNEIL.—The following is a brief account of the society's work for the half-year:—

The annual meeting was held on the 19th and 20th February last. At that meeting it was decided to hold the semi-annual meeting at Sydney. A committee, of which I was named chairman, was appointed to carry out the details and August 8th was named as a suitable date. In answer to the enquiries of our secretary, we ascertained that most of our members in Cape Breton favored postponing the meeting, and the members of the committee, when asked their opinion as to a postponement, generally thought that it would be better to have the meeting there next year. It seems that this was not a unanimous opinion, but the dissenting ones had probably not considered how awkward it is to go visiting when a divorce is about to take place in the family.

In the eight months that have elapsed since the annual meeting, the executive council of the society has met regularly once a month. I will give a brief summary of these monthly meetings.

In March, the question of legislation to prevent gold-stealing was taken up. A letter from the Minister of the Interior in relation to the society's resolution regarding Dr. Haanel's services was read, and the secretary was instructed to reply thereto. It was proposed to send a circular to members, asking for suggestions for improving the government mines report.

In April a report was made of the effort made through F. B. Wade, M. P., to get a gold-stealing act passed at this session of the Dominion parliament. A motion was adopted as follows:—"The council notes with much gratification the introduction into the Nova Scotian legislature of a government measure entitled 'An Act to Encourage Deep Mining in Nova Scotia.'" A copy of this resolution was ordered to be sent to the Commissioner of Mines.

In May, a committee, composed of Messrs. McNeil, Mason, Piers, and Wylde, was appointed to take up the question of collecting for the Provincial Exhibition a first-class mineral exhibit. That committee, through one of its members, interviewed the Commissioner of Mines and as a result, the Curator of the Provincial Museum, Mr Piers, was sent by the department to various districts in the province, and very successful work was done by him in securing an exhibit which, while necessarily not complete, was one that attracted a great deal of attention: and I have no hesitation in saying that it had an excellent effect in directing attention to the mineral resources of the province, especially some that are now little kn[illegible] [illegible] of the most attractive features of this exhibi[illegible] [illegible] tion of building-stones and other such m[illegible] [illegible] reference should also be ma[illegible] [illegible] pared by Mr. Piers and issued by the govern[illegible], g[illegible] a short description of the various economic mineral products of the province, and the amount of development done at the various mines reported. A large number of these useful pamphlets were distributed at the exhibition

At the June meeting, the following were elected to membership of the society:—Messrs. P. H. Moore, Chester Basin; J. B Forrest, Port Hood; and G. V. White, of the Dominion Iron and Steel Co., Sydney. Correspondence was read from F. B. Wade, M. P, regarding the gold-stealing legislation, which he hoped to have passed. It was also reported to the meeting that the local government was conferring, regarding deep mining, with E. R. Faribault, of the Geological Survey.

In July, the secretary announced that the members in the Sydney district favored a postponement of the meeting suggested for August 8th. The secretary was instructed to communicate with all interested, and get their views as to the advisability of holding the meeting later in the year. He was also instructed to interview the Commissioner of Mines with a view to having someone collect samples for the Provincial Exhibition, as before referred to.

In September it was decided to hold a meeting in Halifax on the last Tuesday in October. The following were elected members:—G. H Gillespie, Ervin Secum and John C. Taylor, New Glasgow. The secretary was instructed to write Dr. Bell acting director of the Geological Survey, with a view to getting Messrs Fletcher and Faribault, of the Geological Survey, to attend the next meeting.

At the last meeting, it was decided to secure an act to incorporate the society. This has been done.

These, in brief, are the different matters taken up by the council.

MR. FARIBAULT'S REPORT ON DEEP MINING.

The Secretary read the following letter from W. L. Libbey, criticizing Mr. Faribault's report on the best methods of testing the value of the deeper gold deposits of Nova Scotia, in so far as it applied to the district in which Mr Libbey is working:—

Boston, Oct. 22, 1903.

THE MINING SOCIETY OF NOVA SCOTIA.

The act of the last session of our Legislature, entitled, "An Act to encourage Deep Mining in the Gold Fields of Nova Scotia," has resulted already, among other things, in a report by E. R. Faribault, Civil Engineer on the "Best methods of testing the value of the deeper Gold Deposits of Nova Scotia." The reading of this report, which came to my hand yesterday, suggests some possible criticisms.

I will not undertake discussion of Mr. Faribault's report on the portions of our gold fields to which he has been able to devote enough of his time to make an adequate survey and examination of, as I feel that the warm expressions of commendation I have heard from numbers of our members familiar with the districts, give approval to his work.

His "Classified List of Gold Districts" is an important feature of a report, published by the government of Nova Scotia and presumably with its approval, which is likely to gain large circulation and to carry with it much weight. I desire therefore to call the attention of this society to a portion of the report on territory where I am personally cognizant of the means of information Mr. Faribault enjoyed, and the time employed in getting this information relating to an important industry.

Mr. Faribault drove from New Germany on a Saturday morning to Pleasant River Barrens and spent a portion of the day making an examination of a district in which every prospecting pit was filled with water. Thence to North Brookfield where he arrived about 4 p. m. At Brookfield he worked with only a few hours for eating and sleeping until about 2 p. m. on Sunday—*the next day*,—and during this time he was nearly *two hours* below ground. He left Brookfield and went to Molega. To avoid waste of time and get directly at the point, I submit that no man living could in this time gain information which would justify him in making a classification of a district.

Mr. Faribault's very definite conclusions as to whether or not the government of Nova Scotia may be allowed to aid any other class of deep mining than such as will tend to prove or disprove his saddle-vein theories, certainly open up an interesting field for discussion. I beg to be permitted to observe, however, that in my opinion the men who have money to invest in gold mining will be equally interested in the fact already proven, that gold is found at comparatively deep levels in fissure veins.

My own impression of the intention of the government of Nova Scotia in passing "An Act to encourage deep mining in the Gold Fields of Nova Scotia," (and that impression is not yet modified by Mr. Faribault's report,) is that aid was intended to deep mining as a means to the extension and development of a probably important natural industry. The important commercial fact to demonstrate seems to me to be the existence of gold in such quantities and at such depth as to invite mining capital to invest in this province with a reasonable certainty of meeting such pecuniary rewards as have been met with in other countries. Capital does not care whether the gold exists in saddle veins or fissure veins: the question is, "Can the gold be mined at a profit?" Flippant opinions can only work harm; therefore, I make the motion that the government of Nova Scotia be respectfully requested to suppress such portions of E. R. Faribault's report as are not based on adequate examination of the districts referred to. I reget that my time for study of this report has been so limited and that I shall be unable to be present at the meeting, October 27th.

I am,

Yours most respectfully,

WILBUR L. LIBBEY.

G. J. PARTINGTON.—I think Mr. Libbey is not pleased at the limited time that Mr. Faribault spent in the western counties, forgetting that the latter's visit to the west was not for the purpose of making an exhaustive examination of various properties, but merely for the purpose of classifying the work that was being done in the different districts. The exposures of rock are very plain in the west, and Mr. Faribault went to places where work was being carried on and ascertained how they were located with respect to the anticline. His visit, instead of being intended for the purpose of making an exhaustive examination, was only a rush trip to ascertain what part of the anticline they were working on, and into what class Mr. Libbey's mine should be put. A quick examination would put him in possession of this information, and it was on this point alone that he went there. I think it due to Mr. Faribault to say this.

Dr. H. S. Poole.—If you will refer to Mr. Faribault's report, you will find that there is really no difference of opinion between him and Mr. Libbey, as to the classification of the mine at North Brookfield. Both speak of it as a fissure-vein. The only difference is, as to whether government aid should apply to Mr. Libbey's mine or not. That matter, however, was not left to Mr. Faribault to decide. He was asked to name districts which he thought would be typical of those containing saddle-veins, and the question to be determined was the probability of finding, in the saddles not visible on the surface, gold that would pay to mine. The question of the fissure-vein and its continuance in depth did not come before either this society or the local government, for the continuance of such veins and their auriferous character were not in doubt. Mr. Faribault, after many years of labor, and after collecting data with respect to mining operations in Australia, where anticlines are repeated at shorter distances than with us, came to the conclusion, not only that there would be a repetition of the surface structure as the mines were developed in depth, but that the succession of underlying veins would be found to be as large and as rich in gold as those cropping at the surface. It was practically to determine this that the society was anxious that the government should make a grant. If a mine paid on top, there was a prospect of its continuing to pay in depth within the limits of paying mining.

G. W. Stuart.—I regret very much that Mr. Libbey has felt it his duty to censure Mr. Faribault, and the great work he has been doing for the province. There is no necessity for sinking test shafts to prove the value of fissure-veins. There is no question as to the value of such veins. Once get the pay-streak in them, and there is no difficulty in following it. What Mr. Faribault has endeavored to prove, and I think he has successfully done so, is the probability that in this country our greatest value does not exist in fissure-veins, but in saddle-reefs, and he has endeavored to instruct us how to follow the pay-zone from one vein to another. This is one of the principal things we want to know to guide us in deep-mining. Unless we are able to follow the pay-zones from one lead to another, we will never have deep-mining in Nova Scotia. One of the illustrations which appear in the mining number of the *Nova Scotian*, laid on the table at this meeting, and for which great credit is due to Mr. W. C. Milner, shows at a glance what Mr. Faribault has been endeavouring to bring to our notice. If you will look at the illustration on page 27 of that paper, you will see the line of pay zones, as determined by Mr. Faribault, extending from one lead to another, as the leads overlie each other. I think this is a most valuable thing to have in the mind of every man interested in gold mining in Nova Scotia, and I must pay Mr. Faribault a tribute from my own recent experience in Goldenville, Guysborough County. I started a year ago sinking a vertical shaft on the south side of the anticline beyond where any work had been done, and where I was told by old miners that I would not get gold. Nevertheless, I continued the work, and started the first cross-cut at a depth of one hundred and seventy feet. I had no one to support me, with the exception of Mr. Faribault. When the shaft was one hundred and sixty feet deep, he visited it, and reported to some of my company that I was right, and that I would cut the pay-zone within two hundred feet. Last week, at eighty feet from the shaft, in the cross-cut, I cut a fifteen foot belt showing good values. Mr. Faribault was absolutely sure that by continuing that work I would strike the pay-zone, and I have done so. With the experience we have had in Goldenville, there is not the slightest difficulty in districts that have the anticlines as perfect as they are there, in following the gold zones from one lead down to another. They have been able also to do so at the "Bluenose Mine" at Goldenville.

A. A. HAYWARD.—I look upon Mr. Faribault's work as theoretical. I am glad Mr. Stuart has struck gold, and I have every confidence in the future of deep-mining in Nova Scotia, and I may say I have had confidence in it for twenty years. Twenty years ago I tried to induce the government of the province to subsidize deep-mining, the question being whether gold can be found in paying quantities at greater depths than it has been found hitherto. At Salmon River mines, Halifax County, Mr. Faribault's theory was not demonstrated to be correct. There they sank four hundred feet and drove cross-cuts. As to the cost of doing the work, I am not informed. However, they were not successful in finding paying ore. Whether they would succeed or not at a greater depth, remains to be seen. The lines on the plan referred to by Mr. Stewart, showing the gold zones running down parallel to the axis of the anticline, are, I think, purely theoretical. The fact that Mr. Stuart has succeeded in finding rich gold in the manner stated by him, is no proof generally that auriferous ore lies in zones parallel to the axis of the anticline. I hope that the theory may prove to be correct : but whether it is or not, I believe that gold will be found at a greater depth, and I think no valid argument can be offered to show why the recurring underlying "saddles" should not be as rich in gold as those that overlie them. I believe that we have here one of the largest gold fields on the continent, and that gold will be found here at greater depths, perhaps, than in any other part of the continent.

G. J. PARTINGTON.—Now that Mr. Stuart has proved the existence of the gold zone in these leads or belts, he should give us a paper explaining on what theory he drove the cross-cut. Of course, we all start on theory, but Mr. Stuart certainly started on some well-defined plan of action.

Dr. H. S. Poole.—Mr Hayward has referred to the experience at Salmon River as not bearing out Mr. Faribault's theory. Before accepting the experience there as conclusive, I would like to be assured that Mr Faribault's recommendations or ideas were exactly carried out. Also, whether the percentage of gold obtained at Salmon River was not as large as that at at some other mines that are now being profitably worked?

A. A. Hayward.—The returns in the mines report are the best answer to that. The average was very low indeed.

Vice-President McNeil.—Should we not take into consideration the concentrates which are not in the returns?

A. A. Hayward.—They were also low in value.

G. J. Partington.—The mines report for 1902 shows seven dwts., one gr.

Dr. H. S. Poole.—That is a higher return than is got from some paying mines to-day.

G. W. Stuart.—There was also a very large percentage of concentrates.

A. A. Hayward.—There is no question that the leads worked were auriferous, but they were not in paying quantities. It does not follow that what occurs in one mine will occur in another.

G. W. Stuart.—I do not think that Mr. Faribault's instructions were carried out at Salmon River. The development work was too far west, and they got too far below the level of the paying zones.

Vice-President McNeil.—We all regret very much that Mr. Faribault was not able to be present to-day. We should have liked to have had him here to discuss the subject.

MINES DEPARTMENT REPORT.

Dr. H. S. Poole spoke for the committee on the mines department report.

After further discussion, the meeting approved of the appended communication being sent in response to the request of the Hon. Commissioner of Public Works and Mines:—

The Mining Society.

Halifax, Oct. 30, 1903.

Hon. A. Drysdale,
Commissioner of Works and Mines.

Sir,—The Mining Society having on several occasions expressed dissatisfaction with the annual reports of the Department of Mines, without affecting improvement in diction and in statements of fact, and having again referred to the matter, have been asked by you to particularize and show cause of complaint. We beg to reply as follows:—

We had refrained previously from detailing the short-comings of these reports, with a hope that a complaint in general terms would have been sufficiently stimulating to lead to more care being taken and to improvement being made in the following directions:—In editing the report: in accuracy of statement respecting operations: in accuracy in the tabular statements on the mineral industry.

While typographical errors are liable to occur even when care is exercised, such blemishes can be met by revision and a table of correction. Without such notes, confidence in the accuracy of these reports has been destroyed, as so many errors have been detected that many more are suspected to have been made. Thus the value of these reports is further depreciated, and the mining reputation of the province has been injured.

Accuracy is asked for as the primary essential; then, that a report be a record of what has been done in mining with sparing reference to what may be intended to be done; that it be written in good English; and the matter be systematically arranged under appropriate headings and subdivisions; distinguishing the several localities and mines by the *same* names throughout each report.

Then when these matters, which in most countries are regarded as the elementary essentials of an official report on any subject of public interest, have received attention, hope will be entertained by the Mining Society that matters of more extended interest will be added, as is done by other provinces of the Dominion.

Comment on the last report issued would be incomplete without earnest endorsement of the suggestion, page 38, of Mr. D'Arcy Weatherbe, respecting the enforcement of the law referring to the keeping of mine plans, and to ask with him, why this matter, in spite of frequent complaints, has been for so many years neglected.

The attached slip contains samples of objectionable features taken from the Reports of 1900–1 and 1901–2.

All of which is respectfully submitted by the Mining Society in session on October 27th, 1903, by the hand of

Your humble and obedient servant,

H. M. Wylde, *Secretary*.

The Mining Society submit the attached slip, with examples of objectionable features, taken from the Mines Report for 1900–1:—

"Machinery which is on the ground and are ready."

"They are built of concrete and look fine."

"They are multitubular 5½ x 16."

"Due to the fact that the company takes all their coal run-of-mine, and don't require screens."

"The walls with steel sheets stamped to represent brick gives a neat appearance"

"A complete set are in course of erection."

"The size 13′ and 21′ x 36′ being compound steam corliss valve gear and compound air."

The mildly curious reader would like to be further instructed on "the coachway system" mentioned on page 13, the position of the new (?) "North Seam" at the Vale Colliery, and the new plant of 2200 h. p. boilers said to be there erected. Again, how "up-to-date 1170 boxes of stone and 750 feet of the slope has been made permanent?" Why "a foundation for a pair of 30 feet by 48 feet direct acting link receiving hoisting engines has been erected?" And how "the collection, exploitation and preservation of capital form the basis of industrial advancement?"

Some members of the society go so far as to desire that the indifferent use of the following be avoided :—

"Honourable" and "honorable." "Waverley" and "Waverly." "For the year ended," and "for the year ending." "The company are," and "the company is."

Fifteen mistakes have been detected on page xv. An error occurs somewhere in the fourth column on page xiv, and the table on that page makes the coal pits work 2518 days in the year.

The table on page xi is manifestly imperfect in several of the entries. Broad Cove is credited with producing but 56 tons in the year, while it is stated on page 26 there is an output of 100 tons per two shifts. Mabou is said to have produced 1028 tons with an engine consumption of 5 tons.

The table, page ii, gives the names of only three of the mine agents, one of whom had ceased to be the representative when the report was compiled : while the names of all agents are filed with the department. In it some owners are mis-called.

The table on page xiv takes no note of the smaller coal mines —Jubilee, Strathcona, Scotia, Smith's Mine, Chignecto and Broad Cove.

The table on page xi also takes no note of the output of several of these smaller coal mines spoken of in the deputy's report—Jubilee, Strathcona, Smith's and Chignecto.

No reference is made to operations about the River Inhabitants, etc.

Turning now to the Mines Report for 1901–2, written since the renewed protest of this society, we find in it no improvement. Proof-reading has been as faulty as in its predecessors. It is, however, true, a glimmering of intention to correct errors is shown: one error is noted and has a whole page to itself. It might have been accompanied by many others, *e. g.*, "ors," "thirp," "wheelep," "laboa," etc. It might have substituted—"Survey" for "Society," "Intercolonial" for "International," "Constructed" for "concentrated," etc., and also have avoided the dual use of labor and labour: honor and honour; ended and ending; or the three variants, Thorborn, Thorburn and Thorburne.

In general "get up," many hints might be gotten from trade circulars, catalogues and school calendars.

Page 7 has a line on the drills, evidently adrift.

Page 8 speaks of the coal shipped to Quebec and the United States as "sales," while of that to Prince Edward Island as "exported."

Page 70, "Concentrated at the mine a coffer dam."

Page 9 speaks of extending a seam as though it could be stretched; and hopelessly to the uninitiated reader, mixes descriptions.

Page 10 gives undue prominence by head-lines to lamp houses, etc.; states that 2321 feet of level were driven during the year, which, if true, would be a record worth chronicling

Page 11 tells of a fan 24 x 18 inches, which has a capacity of 200,000 cubic feet per minute,—but perhaps it is the house that has that size.

Page 12 gives to No. 3 Joggins an elaborate equipment it never possessed.

Page 13 leaves Cumberland county and goes to Pictou: page 15 returns to Cumberland, and page 17 reverts to Pictou, without mark or word to show it. Page 13 also gives the gratuitious information that there has been no surface improvement at a certain mine.

But enough has been commented on to show that throughout the report there will be found much that required the blue pencil of the editor.

The remarks already made on the tabular statements apply also to this report: and the table on page 88, which calls for the names of managers at the several mines, gives only three names, and one of the three wrong, while the insertion of at least twenty names might be suspected.

Page 18 speaks of smoke stacks with new features.

A. A. HAYWARD.—In dealing with the mines report, I feel that there will never be any improvement until there is a divorce in the office, and the mines department is separated from the department of public works, and a commissioner placed at the head of the first mentioned department, who will be a practical man, versed in mining, and who will have some progressive ideas as to the wants and necessities of the province.

F. P. RONNAN.—How far are the mine-owners to blame for defects in the information furnished to the department?

G. J. PARTINGTON.—The department has for some years past had one or two engineers employed in collecting information to be included in the blue book: but until the appointment of Mr. D. Weatherbe, I had only seen the inspector twice in twenty years, whereas, since Mr. Weatherbe's appointment, I have seen him once every year. He has shown himself interested in the work, and he reports conditions as he sees them. He has been censured by some mine-owners for doing so, but I think all well-minded men will support him. If we had more like him, we would not have so much to complain of. With regard to particulars furnished, I do not think that the mine-owner is called upon to edit the book. It is true that plans have never been furnished, because they are not in the office, and they have never been there. The importance of it has never been brought home to the mine-owners. To-day, they have to file a plan of the mine, or they will get into trouble.

PLANS OF MINING PROPERTIES. Etc.

Vice-President McNeil. — There was a committee appointed in relation to the balance of the subjects referred to the Commissioner of Mines, and not dealt with according to the views of the society. There are three that are specially mentioned, viz., improved mining plans, the establishment of an assay office, and technical education. I presume the plans referred to are those mentioned in the report of the committee.

Dr. H. S. Poole. — No. I think those are general plans of the mineral districts. I understand that some new surveys and check measurements have been recently made, with a view to replacing some of the plans complained of. Part of Cumberland county has been covered more accurately than before. The gold districts have their plans and are bound by definite distances, while the coal, lead and copper areas are subject to the option of each lessee.

Vice-President McNeil. — One difficulty in relation to applications for gold areas is, that bodies of water are not shown on the plans.

G. J. PARTINGTON.—There has never been a survey of a district with the object of indicating the surface features.

H. FLETCHER.—The question of cost has come up in connection with areas of coal companies. Coal companies which were desirous of having careful surveys, have had to pay for them themselves in whole or in part.

G. J. PARTINGTON.—The condition that prevails in the crown land department is disgraceful. One cannot get a plan of any district in any county of the province that is reliable. There is no continuity about them. If we could make them give us good plans, we would be satisfied. Where I have wanted natural features shown on the plans, I have sometimes had to give the necessary information myself to the department.

G. W. STUART.—In some cases, when I went to make application for crown lands, I found that the land was covered by a "blanket application" from some lumber company, which had been standing for years.

F. P. RONNAN.—It might be desirable to appoint a committee to make representations to the department on this subject in connection with others.

VICE-PRESIDENT MCNEIL.—I have heard much complaint about these plans, and occasionally hardship has been occasioned to men who have prospected on property that they thought they had a title to, until it was measured, and then they found that they had been misled. I think that the society should deal continuously with this subject until some solution is found. Someone has said that perhaps the province cannot afford to do this. I think that the province cannot afford to do without it. I suggest that the society consider the appointment of a special committee to deal with the subject.

J. BAIRD.—We are led astray in many districts by inaccurate surveys. A man may suppose from his plan that he has one thousand acres, when, as a matter of fact he may not have one hundred. I think the only way out of the difficulty is to start with a clean sheet and make new plans, the established lines, of course, being held. I cannot see that it can be done in any other way. It is claimed that in some cases the difficulty about the lines is due to the variation of the compass, but it has been found in one place at Chignecto Mines that the compass reads the same to-day that it did twenty years ago.

A. A. HAYWARD.—This society has been in existence for eleven years, and we complain of aches and pains, but we do not get at the seat of the disease. We may keep on indefinitely appointing committees, but until the actual difficulty is got at, the result will always be the same.

G. J. PARTINGTON.—Would it not be better to do away with the use of the compass in making surveys?

H. FLETCHER.—Some faults in connection with the preparation of plans, result because the surveyor is told to hurry over the work and to spend on it as little time as possible. For this reason he omits to put down such a thing as the crossing of a brook, and where such particulars are not noted one can never tell with certainty where the line has been run. If the crossings of streams and other natural features were given on the plans, you would have something to refer to. As to the variation of the compass in the county of Cumberland, as Mr. Baird says, the variation is now that of the old lines, and the compass is at present where it was twenty or thirty years ago.

DR. H. S. POOLE.—I move that Mr. Partington associate with him such other members of the society as he may deem expedient, and draft a resolution to be submitted to the Commissioner of Mines, on the subject of surveys and plans of the mineral areas of the province.

G. W. STUART seconded the motion, which passed.

ADDRESS BY J. RUTHERFORD.

G. W. STUART.—I desire to call attention to the presence of Mr. John Rutherford, an honorary member of the society, and formerly inspector of mines for the province. I feel sure that our members would like to have a few words from him. Mr. Rutherford has been associated with the mining industry in this province ever since 1865, and no man present can express himself more intelligently on the subject.

J. RUTHERFORD.—I did not expect to be called upon to say anything in connection with matters before the society, and I feel some delicacy in making remarks until I have given more consideration to the subjects under discussion, especially in view of the fact that for sometime past I have been out of actual practice. As has been remarked, I have had a long experience in connection with mining in Nova Scotia, and some things have been mentioned this morning in which at a very early period I took a warm interest.

I have read Mr. Faribault's paper with much interest and pleasure, and I think that he has worked out a very satisfactory theory. Of course, I am aware that by further investigation only, can his ideas be verified; but I do think he is in the right direction.

Reference has been made to the necessity of better surveys of the mining districts of the province. That is a matter that impressed itself upon me when I first came to this country, and one of my earliest efforts as inspector of mines was to direct attention to the want of proper plans. At that time, of course, I was speaking more particularly with reference to plans of the coal mines; but it is easy to see that unless steps are taken to prevent it, a similar difficulty will occur with respect to the gold mines. Montagu was the first place where gold mining was carried on in a systematic manner, and I pointed out the importance of having the surveys there conducted properly; and I also suggested that it would be advisable on the part of the government to appoint a surveyor for the special purpose of keeping up the plans and having copies of them on file in the mines office. There they would be open to the inspection of anyone beginning operations. In respect to coal mines, it was especially important that the bounds should be well defined, otherwise, if one starts in any locality and works towards the boundary, and other operators in the neighbourhood do the same, a connection may be made between the two properties, and great loss of life may result. I mentioned instances where such an unfortunate state of affairs had occurred in England, and was desirous that such occurrences should be avoided here. It seems extraordinary, at this late time, and in view of all you have done, that still no steps have been taken to have the surface properly laid out.

I thank you for the reference to me, and I am glad to be with you again. I miss many faces that I used to see here, but as I now live in town, I trust in future to be able to attend the meetings of the society more regularly and to renew the interest that I have always taken in mining matters in the province.

The meeting adjourned, and resumed at 2.30 p. m.

CUMBERLAND COAL BASIN AND THE GEOLOGICAL SURVEY.

Hugh Fletcher, of the Geological Survey of Canada, exhibited maps of recent surveys of the Cumberland county coal basin, and addressed the society on the "Limits of the Workable Coals of the Cumberland Coal Fields in Nova Scotia." (Reproduced elsewhere).

J. A. Johnson.—We are all much indebted to Mr. Fletcher for giving us the benefit of his great knowledge of our coal fields. His work has been of immense advantage to Nova Scotia. When in connection with the bringing down of the

Dominion estimates I saw that there had been quite a reduction in the amount to be voted for the work of the Geological Survey, I wrote to some of the maritime members of parliament, stating that in my opinion, about all Nova Scotia got out of confederation, was the work of the geological survey. I cannot see what the Dominion government has done for Nova Scotia that we could not have done for ourselves, except the work accomplished by the survey. Notwithstanding the reduction of debt and increase of surpluses, it has been trying to hamper the survey by niggardliness in the amount appropriated for its support. I was glad to receive a letter from Mr. Logan, M. P., of Cumberland, in which he stated he had made representations to the Hon. Mr. Fielding and others, and that the vote would be brought back to the original amount in the supplementary estimates. I am sure Nova Scotia could afford to overbid the Dominion for Mr. Fletcher's services in this province, so that we would have the results of his work firsthand, and not have to depend upon the freaks of lithographers as to the time when the maps shall be published. Sometimes it has taken three or four years to get out a map that should be in the hands of the public in as many months.

I do not think that the government treats such men as Mr. Fletcher with the liberality that it should. If the cabinet ministers and members of parliament who sit in luxury at Ottawa and make laws for us, were to try to follow Mr. Fletcher through brush and mud in all sorts of weather for a month or less, I am sure that they would be willing to treat him with a much greater degree of liberality. The society should pass a resolution and forward it to the government at Ottawa, setting forth the great interest taken in Nova Scotia in the work of such men as Mr. Fletcher, and stating that in our opinion they should be liberally dealt with, and a larger appropriation made for the purpose of enabling them to carry on their work to greater advantage.

A. DICK.—I agree with what Mr. Johnson has said about this important matter. After having been in British Columbia, I have sometimes thought that the east is overshadowed by the west in matters connected with the Geological Survey. I remember at one time when we were in great need of accurate plans in the Kootenays and representations were made to the department at Ottawa, geologists were sent out at once and preliminary plans issued within twelve months after the surveys were made. I cannot understand why it is that in this province where we have vast resources unexplored, and upon which a great deal of work should be done by the department, a more generous policy is not pursued, unless it be that we do not represent our case in the strenuous way that the people in the west do. In the west these matters are looked upon as of great importance, while in this province we appear to let them go by default, with the result that the department has sent down Mr. Fletcher year after year, but allows his plans and other work to remain unpublished. We should make a point of asking the government to give us promptly reports of Mr. Fletcher's work. When his reports are submitted and edited, we do not know how much may have been cut out of them. I cannot understand why it should be necessary to revise at all a report made by such a man as Mr. Fletcher, after he has made a complete survey of a territory. I agree that representations should be made by the society, and I feel that we have been too lax in not pressing this matter in the past.

HON. S. H. HOLMES.—I am sure that the people of Nova Scotia are much indebted to Mr. Fletcher for the attention that he has given to matters that concern us more intimately than they do the people of any other portion of the Dominion. The information he has to-day given to the society shows the probability of the existence of a large field of future wealth in Nova Scotia, and the province should see that effective measures are taken to have the work completed and published promptly. The Dominion government is doing a great deal in this direction but it has a large field to go over, and each part of it has equal claims. When we look at this matter, we must ask ourselves the question, who is to be benefitted by the discovery of new deposits of coal in Nova Scotia? Not the Dominion government, but the government of the province, for the latter will receive all the royalties from the coals contained in any new fields. While I agree with Mr. Johnson that it is important that these elements of wealth should be explored and developed, there is the question whether the local government is doing its whole duty in the matter. We should be thankful for what the Dominion government does, but we should call upon the local government to do its share, for it is the body which will receive the benefit. I think it has been lax, ever since we have been a province of the Dominion, in not sufficiently exploring our mineral resources.

F. W. HANRIGHT.—I wish to add a word of appreciation of the work that Mr. Fletcher is doing. I have had occasion to call upon him for information a number of times, and have always found him willing to give the benefit of his painstaking and careful work in the Cumberland field. In the work that I am doing there in opening coal areas, I am relying upon the skill of Mr. Fletcher. I feel, like others, that it would be of great advantage to people who are engaged in the mining business and who propose to expend money in opening up areas, if they had the plans which are the result of the painstaking study of Mr. Fletcher, at an earlier period than they have been able to obtain them heretofore. While not in a position to enter into a criticism of this map, I wish to express my gratitude to Mr. Fletcher for his extreme courtesy, and to mention that his work, as far as I have followed it, has given the greatest satisfaction.

H. FLETCHER.—If I may be permitted, I would like to say that so far as the maps of the north-eastern portion of Cumberland county are concerned, it is not the fault of the department that they are not issued, but it is owing to my own slowness of comprehension. Only one of the sheets I have shown you is nearly ready for publication. The other four sheets before you were, unfortunately, traced and prepared by the draughtsman of the department, under a misapprehension, that they were ready. The plot of a large portion of the country, from Little Shulee south to Minas Basin near Port Greville, should be ready in a few weeks, but the sheets in the north-east corner may be delayed until spring.

A. DICK.—What would it cost to lithograph these maps?

H. FLETCHER.—I hardly know. Dr. Poole had an offer to publish his map of the Pictou coal fields, 22 x 45 inches, in an edition of 3,000 copies, in eight colors, for $500.

A. DICK.—Would it cost $1,000?

H. FLETCHER.—Perhaps. Certainly more than $500 to the government.

J. A. JOHNSON.—I move the following resolution:—

Whereas the Geological Survey at Ottawa has year after year sent members of the geological staff to investigate the geological formations of Nova Scotia, and particularly of late those in connection with the coal fields in Cumberland county;

And Whereas, in the past, reports accompanied by maps have been furnished to the department, but the publication has been delayed:

Therefore Resolved, That the Mining Society of Nova Scotia, at this, its semi-annual meeting, memorialise the government that at the earliest possible date it supply these maps to the public.

A. DICK seconded the motion, which passed.

DR. H. S. POOLE read a paper entitled "A Trip to West Virginia." (Reproduced elsewhere.)

MINING EDITION OF THE "NOVA SCOTIAN."

VICE PRESIDENT McNEIL.—Reference has been made to the special mining edition of the *Nova Scotian*, advance copies of which have been laid upon the table. I think it only right that we should make some special reference to this work, which, in my opinion is one of the more important works of the kind attempted in this province. It doubtless will prove of great value to the mining industry, as the distribution provided for is very large. I think the society should show its appreciation of a work of this kind.

G. W. STUART.—I move a vote of thanks to the gentlemen who have issued the interesting mining edition of the *Nova Scotian*. I understand that Mr. B. F. Pearson bears the entire expense of it. I think it is a most laudable act on his part, and I move the following resolution:—Resolved, that this society appreciates the efforts of Mr. B. F. Pearson in issuing such an attractive, interesting and valuable edition of the *Nova Scotian*, and desires to thank Messrs. Pearson and Milner for the advance sheets laid upon the table, and so frequently referred to at this meeting.

C. C. STARR seconded the motion, which passed.

MINERAL EXHIBIT AT PROVINCIAL EXHIBITION.

This matter was taken up and suggestions called for, with a view to the improvement of the exhibit.

H. PIERS.—Better accommodation is needed for the collection, and I think it could easily be obtained. This will be a permanent exhibit, and I understand that the government will add to it each year. This being the case, the exhibit should be placed on the ground floor, and should be given more space for purposes of display.

Dr. H. S. Poole.—I saw the collection at the exhibition, and thought it was very creditable to the province. The trouble with the collections which have been made from time to time, is that the better specimens are picked out and made part of exhibits which are sent to other places and, with few exceptions, retained, so that the work has to be done all over again. It is often the case that a specimen is unique, and it is therefore undesirable that a typical specimen should be allowed to leave the province. The exhibition commissioners should now be asked to lend their assistance towards the establishment of a permanent exhibit on the grounds. What we want is a permanent building in which stones of no intrinsic value can be kept from year to year and added to from time to time as those interested in the collection are able to supply them. It might be said that these samples could be boxed up and got out when required; but handling stones and rubbing them together spoils their appearance and gives them a worn look and detracts from their value.

F. P. Ronnan.—There is a building which has been given up to a fisheries exhibit, but which has not been appreciated much, judging from the number and character of the exhibits. Could it not be obtained for the mineral exhibit?

J. A. Johnson.—I expect to appear before the exhibition commission before long, and will bring the matter up. I think it is of great importance. If you try to induce people to go into a building that is not well lighted and ventilated, they will not go. With fish and minerals properly housed and displayed, we should be able to have two splendid exhibits. There should be a suitable building for the minerals, and it should be an artistic building, beautiful on the outside as in the interior, and I will do my best to impress it upon the commission from this point. It would be a pity not to have this magnificent collection kept intact.

A. DICK.—In connection with the coal exhibit a year ago, we went to considerable trouble and expense to get out a large block of coal and send it to Halifax for the purposes of the exhibition. It is rather an expensive piece of work to take out such a large piece of coal and bring it here intact. This year we were asked to do the same thing, but we objected. We thought we had gone to sufficient expense last year, and that the exhibit was here. If you attempt to move such specimens, they will, of course, be broken up. They should last for three or four years. The exhibit made by the Dominion Iron and Steel Co. in 1902 should have been kept intact. It cost $600 to put it here. It is all a question of having a permanent building.

F. P. RONNAN.—It might be worth while to ask what steps are being taken by the government to place an exhibit of our minerals and building-stones at the St. Louis fair. The fair is to be held in a district that we should pay a great deal of attention to.

H. PIERS.—The exhibition branch of the Dominion agricultural department has a man at present collecting for the St. Louis exhibition. If the collection at Halifax is used, it should be returned to Halifax. Any permanent exhibit shown at the Nova Scotia Provincial Exhibition should be displayed on the ground floor. It is more necessary to have a permanent building for minerals, than it is for most other exhibits, because when the minerals are once placed in position, they can so remain from one year to another.

VICE-PRESIDENT MCNEIL.—One or two members of the society might accompany Mr. Johnson before the commission.

DR. H. S. POOLE.—I move, that whereas, in the opinion of this society, the time has arrived when there should be a suitable building erected for the display and permanent maintenance of specimens of the economic mineral products of the province; therefore resolved, that the provincial exhibition commission be requested to carry out this suggestion.

F. P. RONNAN seconded the resolution, which passed.

DR. H. S. POOLE.—I move that the thanks of the society be extended to the Commissioner of Mines for the assistance given by him towards the collection of the mineral exhibit.

J. A. JOHNSON seconded the motion, which passed.

The meeting adjourned.

PAPERS.

On the Corrosive Action of Boiler-Feed Waters.

By Francis H. Mason, F.C.S.

(Read 19th February, 1903.)

In treating the subject of boiler-feed waters, I propose dealing more particularly with waters that have a direct solvent, or perhaps I should say corrosive, action upon iron and steel, and not with those waters that carry mineral salts in solution which become precipitated either at the normal boiling point, or at a higher temperature due to increased pressure in the boiler. This latter kind of feed-water, producing what is known as incrustation or boiler crock, has been investigated by a number of able observers, and their views upon the subject are to be found in the journals of many of our learned societies. Feed-waters having a corrosive action upon iron, may be treated under three heads, and with certain notable exceptions are derived from three sources:

1. That which particularly interests us in Nova Scotia is what I propose calling swamp water, by which I mean water derived from swamps or shallow lakes, the water-shed of which is largely uncultivated land. The deleterious matter in this water is vegetable organic matter, not necessarily of an acid nature.

2. Well water, the deleterious matter in which is dissolved salts, generally salts of the halogens or of sulphuric oxide. It also frequently contains carbonic acid, given off on boiling, and carbonates.

3. Mine water, which often contains sulphates and basic sulphates of the iron group, and sometimes free sulphuric acid. Mine water is liable to contain dissolved salts as in well water.

Swamp water derives its vegetable matter from dead and decaying matter; and also to no small extent from living vegetable matter.

A careful study of Halifax city water, extended over a considerable period, shows that the vegetable matter, as determined by Tidy's modification of Forschammer process, is least in summer and late in winter, and most in early spring and late autumn.

The action of sunlight will undoubtedly account for the decrease in summer, and the frozen ground and decreased amount of surface percolation may to some extent account for the winter decrease. I think the increase in early spring and late autumn, is largely owing to the sap being in the roots of the undergrowth at that time of year, and its being more readily given up to the water percolating around them.

It has been generally supposed that the action of vegetable waters upon iron is due to the organic acids contained in them. This I have distinctly proved is not necessarily the case, although to exactly what the corrosion is due, I have not yet discovered.

It is, however, certain that in the presence of very appreciable quantities of vegetable matter in the feed-water, iron rapidly becomes corroded, whether the water be acid, alkaline, or neutral. I have carried out a number of experiments with a view to finding a remedy. Working on Halifax water when it was giving an oxygen absorption of from 0.5 to 0.6 parts per 100,000, by the permanganate process, (an absorption which by the way classes it as a water unfit for drinking), I have obtained some exceedingly interesting results.

My first object was to find out the amount of iron dissolved by a given weight of water. The method I employed consisted of taking a known weight of iron in the form of clean, soft wire, and imitating the mountings of the boiler by a piece of brass wire intertwisted with the iron wire for a small part of its length. The wires were then immersed in a big flask in which 5 litres of water were evaporated down to 200 cubic centimetres. The wire was then taken out, washed in distilled water, carefully wiped to remove oxide, again washed in distilled water, and finally in alcohol, then dried for a few minutes at 100° c., and weighed. I endeavored to make all the experiments as analagous as possible. Approximately the same weight of wire was taken in each case, and it was in contact with the water for as nearly as possible the same length of time.

The results which I am going to give you are typical experiments. I have chosen this method in preference to giving the mean of a number of experiments, because, 1st, the variation is slight; 2nd, the oxygen absorption varied slightly when the experiments were made; and as I have not yet been able to discover a direct ratio between the oxygen absorbed and the amount of iron going into solution, it was impossible to adjust the one to the other.

Before proceeding further, I wish to raise a protest against the stereotyped method of determining the oxygen absorption. It consists, as many of you are aware, of subjecting a given quality of water, acidulated with sulphuric acid, to the action of permanganate of potash at a temperature of 80° F., for periods of fifteen minutes and four hours respectively. These periods of time were laid down by the water committee of the Society of Public Analysts of Great Britain and Ireland, and they probably fulfilled their requirements. It has been adopted by the public analysts of the Dominion, for whom I contend it is far from satisfactory.

In a number of waters that have been submitted to me for analyses, I have found that the oxygen absorption goes on in some instances for a period of twenty-four hours, and I contend that the object to be arrived at is the total absorption, rather than that taking place in a given time. My own practice is to run a check with distilled water, side by side with the water under examination, and to carry the absorption to practical completion.

My first experiment was to find the amount of iron dissolved. 1 decigramme of iron wire was placed in a flask with 2 litres of Halifax water, the mouth of the flask was covered, with the exception of just sufficient space to allow the steam to come away, 3 more litres of water were added as that in the flask boiled away, and evaporated to 200 cubic centimeters. At the termination of the experiment the iron weighed 9.33 decigrammes, showing a loss of 7.7 milligrammes, or 0.154 parts per 100,000 parts of water. If we take a 100 h. p. boiler evaporating 75 pounds per h. p. per hour in a working day of 24 hours, Halifax water is capable of consuming .2618 pounds of iron, or to put it roughly, a quarter of a pound. This in itself might not perhaps be such a very considerable item if the corrosion were uniform, but it is not. As the water boiled away in the flask, brown spots appeared at irregular intervals on the iron wire. These grew larger as the water continued to boil away, and towards the end of the experiment the wire was corroded completely through at some of these points, so that the iron which was introduced in one coil, was taken out in five pieces, having been completely corroded through in four places.

Viewed under the microscope, the wire was found to be badly pitted in places, while in others it appeared to be as clean as when it was placed in the flask.

I have reproduced some photographs, which I regret to say are not as good as I should have wished. I was unable to borrow a microscope with a photographic attachment, and these photographs have been produced by adapting my hand camera to my microscope, an arrangement which rendered proper focusing particularly difficult. The matter which grew upon the iron wire, viewed under the microscope, had every appearance of bog iron ore. The three high-power (30 diams.) photographs show pitting, the low-power (8 diams.) one illustrates the mode of attack and shows the hydrate of iron attached to the wire.

Having clearly proved by a number of experiments that Halifax water had a corrosive action on iron, I set about to try and find a remedy. Halifax water at this time showed a distinctly acid reaction with phenolphthalein, and thinking this the probable cause of its corrosive action, the foregoing experiment was repeated, the water having 7.2 cc. of centinormal soda solution added to it, the amount required to neutralize it. The brown "fungus" appeared as before, only to a more marked extent, and the iron wire began breaking earlier in the experiment. At the end of the experiment, the wire had lost 1.32 centigrammes, considerably more than in the experiment with the plain water. This clearly showed the cause was not due to acidity, as the residual water gave a faintly alkaline reaction. It occurred to me that it might be possible to break up the organic matter with permanganate of potash. The exact amount demanded by the oxygen absorption test was added, and the experiment again repeated. In this case no brown "fungus" appeared. There was a slight discoloration along the whole length of the wire which remained intact until the end of the experiment. On weighing, it was found to have lost 4 millegrammes, almost halving the loss with plain water. Unfortunately for the success of this as a remedy, hydrated dioxide of manganese was formed, which adhered most tenaciously to the flask, and threatened to form a most refractory boiler crock.

From the amount of permanganate demanded by the oxygen absorption test, I calculated the amount of bichromate of potash required, and again repeated the experiment. The iron wire remained clean and bright throughout the whole experiment. It was found on weighing to have lost 1.8 millegrammes, not quite one quarter of what the plain water corroded away. The residual water was placed in a stoppered bottle and the undecomposed bichromate determined by adding potassium iodide and sulphuric acid, heating, and when cool, the liberated iodine was titrated with this sulphate of soda, and the amount of undecomposed bichromate calculated. The water was found to have decomposed only 11.86 per cent. of the bichromate added.

The exact amount of bichromate (7.35 millegrams) demanded by the previous experiment was added to the water, and the experiment again repeated. The wire remained clean and bright as before, and upon weighing at the termination of the experiment, was found to weigh 0.1 millegrammes more than when it was put in. Viewed under the microscope it was as clean and bright as before the experiment. The very slight increase in weight was undoubtedly due to oxidation, but so slight that it could not be detected by the microscope.

The amount of bichromate required for 100,000 parts of water was .1571 parts, or to take the 100 h. p. boiler under the same conditions previously mentioned, 0.267 pounds per day, which at eight and a quarter cents a pound, would give a cost of 2.2 cents per day.

So far as Halifax city water is concerned, the addition of small quantities of bichromate of potash will be found to prevent the corrosive action upon iron, and I see no reason why it should not be equally effective with other waters high in vegetable matter, at any rate with those that obtain their vegetable matter from a similar source.

There is nothing formed to cause a boiler crock. It is cheap and in every sense it appears to be a desirable remedy. Exactly what chemical reactions take place I have not discovered, except that the action is one of oxidation. The total solids in Halifax water only amount to from 3 to 4 parts per 100,000, of which from 50 to 60 per cent. is organic matter, so that a very large quantity of water has to be evaporated to obtain a sufficient amount of material with which to work.

From the amount of undecomposed bichromate at the end of experiments in which the exact amount demanded by the oxygen absorption test had been used, it is evident that only a small proportion of the organic matter had been oxidized. The residual 200 cc., too, appeared to be as thick and muddy with organic matter when the bichromate was added, as when the plain water was evaporated.

Previous methods of treating waters high in vegetable matter have, to the best of my knowledge, for the most part been carried out before feeding the waters into the boilers. They may be briefly reviewed as follows:—

Filtrations through limestone chippings, the filter being intermittent. This method was devised, I believe, by Sir W. Crooks. The object of the intermittent filter is increased areation. The process answered well, but considerable difficulty was experienced in keeping the limestone active. It was found that after a short time the latter became slimed, and had no further action. Subsequently a layer of sharp sand on the top of the limestone chippings was found to considerably increase the life of the filter. It appears to me that with certain waters a considerable quantity of lime might be taken up in an unstable state of combination which might subsequently form a refractory incrustation in the boiler. Adding carbonate of lime in solution as bicarbonate and precipitating with milk of lime, a method due to Dr. Percy Frankland, has been found to precipitate the organic matters with the carbonate of lime, which is allowed to settle, and the water, removed by decantation or filtration, is in an excellent condition for both economic and industrial purposes.

Slow percolation through spongy iron or iron borings is another method which has met with some success, and it will be at once evident that its object is to satisfy the water with iron before it enters the boiler. Suspending zinc plates in the boiler has been recommended, and its use at times has been attended with only partial success.

Since making my own experiments, I find in the last issue of the *Chemical Society's Journal* a short notice of the process in which permanganate of lime is used and the excess of the reagent removed with iron, but no details or results are given.

When the water is being treated for boiler purposes only, I consider the bichromate process has a considerable advantage by virtue of its simplicity and cheapness, and also that a very considerable excess of the reagent, while not so good as the proper amount, is still infinitely better than using the water in its original state.

It would be necessary in the first place to submit the water to a chemist to find the proper quantity of bichromate to be used, after which, provided care is taken to see that there is always a small excess of the reagent present, (a simple method could be devised that the engineer in charge could rapidly learn,) there should be no further necessity for a chemist's assistance. The most convenient method of adding the reagent would be to make up a stock solution, the strength of which could have some simple ratio in pints to the amount of water used per day.

I now come to well waters, and while I have nothing original to give you on this class of water, I thought that it would make this paper more complete if I briefly reviewed some of the researches of other workers. The dissolved solids most frequently met with in well waters consist of calcium and magnesium, in combination with carbonic and sulphuric acid and chlorine, sodium and potassium in combination with sulphuric acid and chlorine, and less frequently iron and aluminum as chlorides and sulphates. Other elements either exist in such minute quantities or are so rarely present in water that they hardly come within the scope of this paper.

I will deal with these salts separately. Carbonate of lime held in solution in carbonic acid is precipitated at and below the normal boiling point with evolution of carbonic acid. Moist carbonic acid is an active corrosive upon iron, while the precipitated carbonate forms boiler incrustation. By far the most satisfactory method of removing both the carbonate and free carbonic acid is Clark's process. This consists of adding milk of lime, in the exact proportion to neutralize the whole of the free carbonic acid, and thoroughly incorporating the two by stirring, when both the added lime and that in solution as bi-carbonate becomes precipitated as carbonate. The precipitate is then allowed to subside and the water drawn off, or the water may be freed from the carbonate by forcing it through filter cloths.

Sulphate of lime has only a slight corrosive action on iron. At the temperature of the boiler the sulphate, which is dissolved as a hydrated sulphate, loses its water and becomes precipitated as an almost anhydrous salt forming boiler incrustation. It may be removed by the addition of the necessary proportions of hydrate or carbonic soda or potash, together with the application of heat, the lime being precipitated as carbonate, leaving sulphate of soda or potash in solution.

Calcium chloride, according to Ost, has a marked corrosive action upon iron, coating it with black magnetic oxide. No iron passes into solution. There is practically no remedy except distillation known for water containing large amounts of this salt. The calcium could be replaced by sodium or potassium, but the chloride of these two metals act similarly to chloride of calcium.

The salts of magnesium are amongst the worst enemies to users of boilers. The carbonate, which is generally associated with carbonate of lime, forms a most tenacious incrustation. It may be removed in the same way and at the same time as the carbonate of lime, only it is necessary to add caustic soda or potash with the milk of lime.

The sulphate and chloride of magnesium both form coatings of magnetic oxide of iron on the boiler plate, the irons passing into solution. In the case of the chloride, Wagner claimed some years ago, and it had been generally accepted, that in the high temperatures of the boiler it was broken up into hydrochloric acid and oxychloride of magnesium. Recent researches of Hermann Ost go to show that such is not the case, but that a reversible reaction takes place which may be expressed by the equation, $MgCl_2 + FeO \leftrightarrows FeCl_2 + MgO$.

Magnesium salts are dangerous in boiler waters, and as they can be removed by hydrate or carbonate of soda and heat, it is always safer to replace them by the far less injurious soda salts.

Chlorides and sulphates of the fixed alkalies form a coating of magnetic oxide of iron, and can only be removed by distillation.

Besides, any of the foregoing salts found in deep well waters, mine waters may contain sulphates of the iron group and free sulphuric acid. Sulphates and chlorides of iron, especially when in the ferric state are highly dangerous in boilers, becoming reduced to the ferrous state at the expense of the boiler plate, and when in the ferrous state to basic and oxy salts, also at the cost of the boiler plate. When it is necessary that such waters should be used, the iron should be replaced by the far less noxious soda salts, by the addition of carbonate of soda.

The sulphate and chloride of aluminium behave like those of magnesium, and may be removed in the same way.

All these processes of rectifying water should take place before the water is fed into the boiler. It is impossible to lay down any hard and fast rules with regard to how much of any one of the foregoing salts is allowable in a boiler water. The injurious effects of the presence of one salt are often neutralized by the existence of another. Thus, for instance, with waters containing magnesium chloride, Hermann Ost found that if the water contains two parts of carbonate of lime for every five parts of magnesium chloride no appreciable action takes place, when working under a pressure of five atmospheres.

Again, a fairly hard or scale-producing water may contain much more organic matter, without injurious effects, than a soft water, the scale forming a protective coating on the iron and preventing the attack of the organic matter. The pressure under which the water is to be used must be taken into consideration in choosing a boiler water. A water which is suited for a low pressure may often be altogether unsuited for a high pressure boiler.

Just a few words in conclusion in condemnation of the haphazard use of boiler compounds. It is absurd upon the face of it to suppose that any one remedy is going to be a universal panacea for the ills of all boiler waters. The disease must be diagnosed and then the remedy can be applied, and this will be found to be infinitely cheaper and more satisfactory in the end, than piling into the boiler a quantity of unwholesome nostrums masquerading under the name of boiler compounds, which seldom do any good and often produce considerable harm

I may possibly be accused of mixing up the metric and avoirdupois systems of weights and measures in this paper. The experiments were carried out as is usual in laboratory work in the metric system. As many of you may not be familiar with that system, those weights and measures which I particularly wanted to impress upon you have been converted into the English system.

DISCUSSION.

Dr. A. H. MacKay.—The material affecting boiler water to the extent sometimes of causing it to have a very bad odor, is probably organic matter undergoing putrefaction. I would hardly expect the oxidation of this matter to cause any injury. On the contrary, I am under the impression it would have the effect of reducing the injury.

Some Aspects of Technical Education.

By T. B. KIDNER, Prov. Supervisor of Manual Training, Truro, N. S.

(Read 19th February, 1903.)

The question of technical education being such a complex one, and so many attempts having been made to solve its problems, as viewed from different standpoints, a consideration of some of its many aspects may be of interest at the present juncture.

While the necessity for technical education seems to be generally admitted, there is great diversity of opinion as to the best method of applying this remedy for the present state of affairs; that is, if we are to judge from the widely different methods adopted or recommended by its advocates. The scope of technical education is so broad and its aims so numerous, that this divergence is quite natural, and the apparent confliction of thought is simply due to the many phases of the question which present themselves.

There are those who hold that the training of the leaders, the "Captains of Industry," is all important in these days of machinery and minute sub-division of labour.

Others maintain that the training of foremen and managers of departments is the greatest necessity, and some of the most celebrated of the European schools of technology are planned solely with this in view.

Another school of thought insists that the higher training of the leaders is of little use unless the workmen themselves are educated in the scientific and theoretical principles underlying their trades or occupations.

Others again, and these an increasing number in many countries to-day, are of opinion that no system of technical education can succeed unless some radical changes are made in the methods and subjects of education in the primary schools.

They would, therefore, commence their innovations there, and thus provide (in their opinion) a good foundation for the superstructure of specialized technical training later on.

As with most questions, all these divergent views and theories may be quite sound and all of the methods advocated necessary, but so much depends upon the point of view. Again, there are no two trades or industries wholly alike in their conditions, and the form of technical education adapted to one may be wholly unsuited to the other. At the Congress on Technical Education, held in London in the summer of 1897, and attended by most of the leading scientists and educators of the world, Prof. Sylvanus Thompson put this very clearly. He said:—

"Technical education means a different thing in every trade, or group of trades. Take the following cases:—In certain handicraft industries, such as that of the zinc worker, every man must be a skilled workman. Besides a large amount of experience to be gained only in the craft itself, he needs a certain knowledge of geometry of a particular kind. He must know something about the properties of metals, about soldering, about corrosion and its prevention.

"The acquisition of this knowledge does not necessitate many years of study, nor compel attendance in any very expensive laboratory; but every man must get something of this training. Take, by way of contrast, the technical training required in one of the chemical industries, such as that of the manufacture of dyestuffs. The work in this industry is carried out by a few highly trained chemists, an engineer or two, and a large number of unskilled labourers. The industry in no way depends upon the training of the labourers. It would not be benefited to any perceptible degree by opening evening classes in chemistry for them. On the other hand, its success is vitally bound up in the possession of a few properly trained chemists—men who have devoted three or four years at least of their lives to studying chemistry in properly equipped laboratories. Contrast these two cases—the most extreme that occur to me. In one industry the right and appropriate sort of technical education is the training of the many by a species of not very advanced instruction, which can be readily carried out in any evening continuation school where a room can be spared for a workshop, and where a teacher can be found who is himself a skilled metal worker, well trained in geometrical drawing. In the other industry, the right and appropriate sort of technical education is the high training of the few in an elaborate course of study, conducted in laboratories expensively equipped and provided with appliances for research, and to which several years are continuously devoted. Either kind of education would fail to meet the needs of the other industry. The man who had spent three years in the continuous study of the higher geometry would find no place in the zinc-working industry, while the chemical factory has no use for the smatterer who has picked up the bare elements of chemistry in evening classes."

With such an illustration before us, it would seem that the first thing to be done before deciding on any scheme of technical education for the improvement of our industries is to ascertain by careful inquiry and the experience of other countries, just what form it should take, and how it may be best applied to our existing conditions.

Leaving out agriculture, for which technical education is provided to some extent, our chief industries are mining and engineering. From the nature of things, these will in time be followed by various other industries which depend largely on these two for their support and existence. How, then, can these two industries be best reached and most benefitted by technical education? What are the needs that are most pressing and apparent in them? They may be placed somewhere between Prof. Thompson's extremes, for they both require highly trained leaders to manage and push them forward, and, in the case of engineering especially, every workman requires to be trained to a greater or less degree. Draughtsmen, pattern-makers, turners, fitters and machinists, are all required to be highly skilled, and a scheme of technical education for the engineering trades must deal with this aspect of the matter. In mining, the demand seems to be, in addition to that for a few highly trained specialists, for technical education which will help the practical miner to fill the various responsible posts, above and below ground, for which his training in actual mine work, added to this technical instruction, renders him eminently fit.

As you are aware, the movement for the higher training of the future leaders of these industries is in good hands, and seems likely to become a success. It may be well, therefore, to consider the question of providing some means whereby the rank and file may also be given an opportunity of supplementing their practical knowledge by some theoretical and scientific training. That the demand for this sort of training exists can be readily shown by the fact that hundreds of our young men are attempting to obtain it by means of the various correspondence schools whose advertisements are spread broadcast over the land. While not for a moment depreciating the good work that is being done by their means, it seems easily demonstrated that a good system of local schools could do the same infinitely better, and reach a far greater number of pupils.

Competent authorities estimate that the amount of money going out of the country annually for these correspondence courses is sufficient to maintain a most complete system of technical education. It is estimated that no less a sum than $150,000 is annually taken from the city of Montreal alone in this way; and about that sum from the three Maritime Provinces. The demand then for technical education of this sort is so obvious that it is scarcely necessary even to call attention to it. But, as to the best means of meeting this demand, much thought and care will be necessary before a decision can be arrived at. Experiments will have to be made, and, whatever scheme may be adopted, it should be elastic enough to permit of this and its adaptation to particular localities.

In considering the question, it is right and expedient to glean what help we may from the experience of other countries, and it seems almost natural to turn to Germany as the embodiment of all the virtues in this matter. It has become so common a thing to refer to Germany's technical education as the cause of her tremendous advance during the last thirty years that it is often overlooked that many other factors have contributed to her success.

First, it seems to me, is the general sense of discipline inspired by her military and bureaucratic system of government. That counts for a great deal, and renders easy the enforcement of enactments which would be regarded in this country as infringements on the rights of the citizens. For instance, in certain towns in Prussia attendance at continuation schools is compulsory upon all youths engaged in the leading industries. Such a regulation would, I venture to say, be fiercely opposed if attempted here.

The greater industry of her people, the lower standard of living, and the consequently low rate of wages for which her workmen are content to labour: also the lower profits which her capitalists are said to be content with, are other important factors. Some authorities consider it open to serious doubt whether German methods of education would succeed in other European countries, and they may be even less suited to countries so different as ours is. Probably, every country will have to work out its own problems, and varying methods are sure to result. Nova Scotia will prove no exception to this, but at the same time much help can and should be gained from the experience of other countries which have been before us in this matter.

Germany's experience may be of great service to us, for it must not be forgotten that she has by no means limited her technical education to the higher branches, but that every grade of it has been established. Apprentice schools, workmen's schools, schools for training foremen, and so on up the scale until we reach the highest scientific training given in the world to-day.

In the case of Great Britain, the greatest attention has been paid there to the technical instruction of the masses, and higher technological training has not hitherto received nearly as much attention. The decay of the apprenticeship system, and the subdivision of labour caused by the use of machinery in so many trades in Great Britain, have emphasized the need for some instruction which shall in part make good the loss of the older methods of the training of workmen. One result of the Royal Commission on technical education in the early eighties of the last century, has been the establishment of a vast system of evening classes throughout the land. These classes are open at a nominal cost, in most cases, to apprentices, workmen, foremen and others engaged in the various trades. Systematic courses have been arranged for practically every industry—largely by the leading men of the industries themselves.

Speaking generally, the courses are divided into three stages: First—A course of combined lectures and workshop practice, embracing the more elementary processes of the particular industry. Second—A course of instruction in science as adapted to its particular needs. And third—An advanced course involving a combination of the first and second, and designed for foremen and shopleaders. In some instances, such as the building and engineering trades, it has been found necessary to have a preliminary course in addition. This consists of mensuration, workshop arithmetic, simple geometrical and other drawing, such as to fit the students for the special work of their trade classes. In one of the large arts and crafts schools in London, with which I was connected, it was found desirable to give all the evening students this preliminary course. This, because many of them had, to use a common phrase, "forgotten all they had learned," and also largely from the fact that the general trend of their elementary school studies had not been towards a practical application of knowledge. It seems to me that, generally speaking, the bulk of our young men realize what an education really means to them only after they have left school, and it is at this moment of this realization that they turn to whatever agencies are available to supply the deficiency so often felt. It is then that an efficient system of evening classes will attract the young man, and he will be thereby induced to spend his leisure in self-improvement for his own and the community's good.

I said earlier, and I think you will agree with me, that the demand for this sort of technical education in Nova Scotia is evident. How, then, can we best meet it, and give every young man engaged in our trades and industries an opportunity of obtaining instruction in the theory and science of his particular occupation ?

In my opinion, this may be done in two ways at least: First, by establishing in some of our larger industrial centres some special evening schools. Secondly, by extending and developing our present system of evening work as carried on by the Department of Mines.

For the first way there is not much difficulty in planning and equipping a suitable school with class rooms for lecture work, a drawing office, laboratories simply equipped with physical apparatus illustrating the principles of applied mechanics and chemistry; workshops for wood and metal-working, to illustrate the work of the drawing office, and to give opportunities for students to obtain more knowledge of processes and mechanical principles than their daily work gives them opportunity for.

In neither of these directions need the equipment be very elaborate, however, for it must be remembered that the actual processes of any industry are best learned under its normal conditions in the productive workshop; in fact cannot be properly acquired in any other way. The school at best only can supplement the knowledge gained from actual, everyday experience. Again, the underlying principles of many trades and industries can be taught with practically the same equipment, and that of the simplest sort.

The great difficulty will be the obtaining of suitable teachers, men able and willing to give the necessary theoretical instruction and thoroughly conversant with the practical needs and difficulties of the actual work. Such men are unfortunately scarce ; and if any scheme of evening technical instruction is to be successful, we shall have to rely very largely upon the help and co-operation of the men engaged in leading and responsible positions in the industries involved. Such men are doubly desirable, for they are conversant with the latest methods of actual practice, and, in addition, are bound to command the respect of their pupils—mostly youths and men under them in their daily work and would-be-followers in their footsteps. For drawing office instruction, who is more suitable than the practical draughtsman, acquainted, as he is, with the thousand and one problems of daily occurrence in his work ?

I need scarcely elaborate this, for many instances will occur to you where the talents, skill and experience of our leading men would be of inestimable benefit to our young men if placed at their disposal.

There is one thing, however, to be remembered in this. Speaking from experience of some years of this sort of work, I may say that scarcely any form of teaching with which I am acquainted requires more patience, zeal and enthusiasm than this same evening class work. Sometimes the apparent results are very discouraging—pupils expect too much and wish to run before they can walk, or they become careless, and the classes dwindle. But the youths who mean business and do stick to the work and the teacher, are not only a compensation to him, but are sure of a reward for their efforts in some good post for which they may thus qualify themselves.

The many counter attractions in our large centres of population often seriously interfere with the regular attendance of evening students. Therefore, in any scheme of this work the social side should also be kept in mind, and popular lectures and entertainments arranged for at intervals.

Another drawback arises from the varying attainments of the students presenting themselves. This necessitates a large amount of individual instruction in some cases, if progress is to be at all uniform. However, these are difficulties met with in all teaching, and can be overcome by perseverance and patience on the part of the teacher and taught.

You are, perhaps, wondering what this has to do with your association. It is just this, that many of the great institutions of technology that exist to-day are the outcome of some endeavour to solve the problem of technical education by some association of practical men. One of the great technical schools of Chicago, long known as the Manual Training School, is the outcome of the enterprise and public spirit of a body of business men, the Commercial Club of Chicago. Its influence has been enormous, and it has been widely imitated; it now forms a part of the University of Chicago since founded by Rockefeller's millions.

Among European institutions, many instances can be found where their inception was due to the desire of the manufacturers of a town or city to improve the status of their employees and thereby of their business.

To name only one or two established in this way. The textile school of Crefield, the great centre of the silk and velvet trades of Prussia, is considered one of the finest in the world, and was started by the leading men of those industries there. The great French rival to the Crefield Institution, the school at Roubaix, was also commenced in this way, and many other well known instances can be cited.

Many schools in Europe have been founded by the ancient trade guilds or societies, the medieval prototypes of our modern associations and institutions.

The evening classes to which I have referred as a feature of technical education in England, were carried on for years before the government took the matter up by private bodies, viz., the Society of Arts and the City and Guilds of London Institute.

If a beginning can be made, however small and unpromising it may appear, growth is sure to follow. We have a habit of looking to the government to do so much for us that it is sometimes well to rememember that a private body can often take the initiative much better itself. As far as I am able to learn, there has never been much difficulty in getting governments to help in these matters, if shown a way. I do not think that our government will be different from others in this respect, and I have therefore ventured to present these few points for your consideration. If in some industrial centre or centres in this province a small scheme could be set going, the ways and means would, I am sure, follow in due course.

The other method I suggested, was to develop our present system of evening class work. I think this could be done at first in connection with such a school as I have suggested. The staff of the school could be utilized as peripatetic lecturers and instructors, visiting a district say once a week, giving instruction and setting work to be done in the interior between the visits. Arrangements could be made whereby promising or earnest students could be sent to the central school, or even to some higher institution for short periods of a week or so, for work in which special teaching appliances are necessary. In England, the coal-mining industry has benefited greatly by the system of employing travelling instructors to visit the districts of a coal field. At first, the aid of managers and others had to be enlisted, but as the work grew it became possible to employ men wholly for such work. The local technical education authority usually manages the classes under these schemes. The leading industries of a district are always represented upon the managing bodies, prominent men of the industries being appointed because of their acquaintance with the needs of the locality, and of their special manufacturers or trades.

Here in Nova Scotia the travelling instructor scheme would be the best way of reaching the young men in many districts, and I believe it could be worked very effectively. We have seen what can be done in this way by our department of agriculture. In other countries excellent work has also been done in this manner in many other lines of industry.

The aspects of technical education to which I have ventured to call your attention are not the highest, but I submit that they are at least as necessary as the higher schemes are. The more intelligent and better trained that the rank and file are, so much the better for the future leaders of our industries. We need all forms of technical education, and from all of them good must result. Some may be more necessary than others, but I submit that the benefit which would follow from that form of technical education which deals with what we may term the lower aspects of the question, would well repay the time, trouble and money which may be bestowed upon it.

DISCUSSION.

Dr. A. H. MacKay.—We have a general system of manual training in woodwork introduced into many of the schools now and the natural sequel is the extension of the work in the largest centres by having some metal work in several sub-branches, giving some training in the elements of work of the kind generally needed in the province. We could also in certain industrial centres, I can conceive, very easily expand the the mining schools. We might begin by giving special instruction in that which is felt to be most necessary, and if success is obtained in that, then the next most important subject could be added. I think the better plan would be to feel our way out a little at a time, and when we find we are successful in this, add the next important department. It is hard to launch a project perfect in the first trial, there are so many things to be taken into consideration. I think our manual training work should be extended, and practical instruction, as in the case of our mining schools, developed in the industrial centres of the province.

A. McNeil.—This is the first time we have had with us the supervisor of the manual training schools of the province, and it is a great pleasure to have him present. When we first took up the subject of technical education in this society, the manual training school at Truro had just been started, and we thought it would greatly tend toward preparing a basis for higher technical training. It is through Mr. Kidner's influence and ability that great impetus has been given to manual training instruction. I am informed there are nineteen manual training schools in operation in this province. That is a great work.

Observations on Gold Milling.

By J. G. McNulty.

(Read 19th February, 1903.)

Beginning with the self-feeders back of the mortars, it is a good plan to have the adjusting parts to come on the left hand side, or opposite the belt side. This permits the mill-man to work with far more freedom.

A plate-iron lining is of benefit in the throat of the mortar; for, besides protecting the throat from wear, it serves as an apron to catch any ore dropping from the feeders. The iron plate rests on the throat of the mortar, comes up over the back part, and is turned over and out some five or six inches.

As it is frequently necessary to open and close the battery feed-water supply, and several minutes are wasted in again securing the proper working flow, it will be found convenient to have a globe valve on the pipe leading from the main water supply pipe, to the feed water pipe with two or more " bibs " at the top of the mortar. The globe valve is always set right for the amount of water required. In hanging up the stamps the two " bibs " can be quickly shut off, and when opened again the flow of water is of desired volumn.

I have made extended tests with the front water feed versus the top water feed, and have found the former a decided advantage, especially with ores carrying a considerable per cent. of sulphurets or clayey gangues. The crushing capacity is considerably increased, less slimes produced, and the sulphurets in better condition for concentration.

The water supply for the various purposes about a large mill, should, in so far as is consistant with the conditions, be independent, and the supply drawn from head boxes, giving a uniform pressure. In case wood be used for fuel, it is a good idea to construct a large wooden hopper with a filter bottom, near to the boiler room, as a receptacle for the ashes. The "leach" from the ashes, fed to mortars by drip cocks, will be found beneficial in keeping the mercury active; especially in the presence of considerable sulphurets.

Various methods are to be found in our mills for attaching the screen to its frame. The following will be found efficient and convenient:—The screen frame is made of 2 in. seasoned hard wood, framed, and provided with ten ¼ inch stud bolts, four along the upper and four along the lower sides of the opening, with one on either end. The screen is punched from a template to fit over these studs, and is held in place by an iron frame made of 3/16 inch thick flat iron, one inch wide, bored to fit over the studs. The screen frame opening is 5 inches by 50 inches. With a suitable socket wrench the stud bolt taps are readily removed, and the screen taken out. One side of the screen frame is made wider than the other, so that by reversing, the depth of discharge may in a measure be compensated for. Intermediate posts are eliminated, thus admitting an uninterrupted flow of pulp along the entire length of the screen.

A convenient method for handling a roll of screen, is to place it on a spool or reel, unroll the length desired on to a table which has a slot running through the center its entire length, then with a stout knife, guided by the slot, the amalgamator readily cuts off the size desired. Low sides hold the screen fair on the table. This simple device keeps the roll of screen intact, and will be found quite a saving of time, especially in large mills.

There is a growing tendency in milling to utilize the stamp mill more as a pulverizer, and depend less upon the mortar as a means of saving gold; that is, endeavoring to make a combination machine of the battery. The idea, I am aware, is quite at variance with the general mill practice of the province. Some months ago I made a series of special test runs, in a large mill then under my management, and the results convinced me that there was no practical gain in maintaining lip plates, chuck-block plates, and the various other forms of plates, interposed between the discharge and the apron plates; unless it might be that they offer a slight gain in plate area, but additional trouble in cleaning up. There is very little danger in having too much apron plate area. The coarse gold that may be present in a given ore will naturally find its way down between the dies, if conditions be favorable, while the apron plates will take care of the finer gold passing the screen as amalgam.

To maintain the plates up to a high standard of efficiency, they require constant care and attention on the part of the amalgamator. The promiscuous use of chemicals, particulariy potassium cyanide, as a means of attaining this end, should be condemned. Hard persistent rubbing is by far the most efficient, and indeed the only method of keeping the plates in the condition they should be to do effective work. Rather than use cloths in dressing and working up the plates, a stout piece of rubber ¾ inches thick, cut to a desirable size, say 6 x 3 inches, will be found far more effective.

By having the apron plates in sections of say 3½ feet in length, they admit of rotation, or having their relative positions changed in the series, ultimately giving a plate equally sensitive and uniform throughout its entire length. The plates are arranged so that succeeding plates average ¾ inch, with about the same drop between plates. In construction, the plate taken should be substantial, readily adjusted, preferably by slot wedges at the lower end, and rest on supports independent of the batting or mill floor system, so as to reduce the vibration to a minimum. It is advisabe to pass the discharge from aprons over a cross screen, which is nailed to a light frame and set into the launder at the foot of the table, before it enters the trap or passes to the concentrator, as coarse grains of pulp are apt to find their way on to the plates in changing screens, etc., and become a source of annoyance on the concentrator.

In order that the amalgamator may have the screens in full view at all times, special curtains in front of the screens should be discarded when possible.

In setting up concentrators with a view of securing the greatest efficiency, one can not observe too much care in providing a substantial foundation. A common method is to set the carrying frame for the concentrators on the mill floor and depend upon a few nails to hold it in position. In setting up tables of the Wilfley type, I have found it good practice to construct two rough walls of masonry, with anchor bolts to hold down a 6 x 8 inch frame, on to which the carrying frame of the concentrator is substantially bolted. This arrangement adds very little to the cost of installation, insures the possibility of getting the best duty out of the machine, and materially reduces the cost for duplicate parts.

It has occurred to me that even though the amount of sulphurets in a given ore be not sufficient to justify concentration, it might be advisable to convey the pulp after amalgamation over a concentrator, having previously passed it through a "reduction" box, a large Spitzkasten, in order to sufficiently reduce the volume of the pulp coming from the mill. The arrangement would certainly make a very efficient trap, producing a product which might be treated from time to time in a clean-up barrel.

In cleaning up I use a clean-up barrel of the Truro foundry type, and find it very convenient for many other purposes than the actual clean-up, in the way of working over the sweepings and workings of the mill floor, iron removed in cleaning amalgam, trash collected from behind the battery screens, etc.

The barrel is placed so as to admit of easy changing from the plate floor, with ample fall below for the installation of a sluice and head box to receive the discharge from the barrel. In discharging the barrel, the pulp passes over a small grizzly or coarse screen, within the head box, so as to separate any large pieces of material that may be present, to be afterwards hand-sorted. The material passing the grizzly goes direct to the sluice, which is approximately 12 feet in length by 18 inches in width. The bottom of the sluice is laid with ordinary rubber door mats, butting ends, and held in place by cleats. This arrangement is simple and effective for collecting the mercury and amalgam. The mats are readily removed with their charge to the clean-up room. As a precautionary measure, the pulp from the sluice is run over a three-tray rocker.

The mill flooring should be double and with sufficient slope to carry all washings into a launder extending along the entire length of the mill and discharging into a sump.

The provision for ample room and light are too often neglected in the average mill structure. Both are important factors in expediting the routine work and repairs.

In submitting these brief observatlons, I feel that while nothing verging on the original has been advanced, they may, in a measure, refresh ideas in connection with the subject.

The Modern Method of Coal-Washing.

By C A. Meissner, Sydney, C. B.

(Read 19th February, 1903.)

I herewith present to you a few notes on the Campbell Coal-Washing Table that may prove of interest, especially in so far as this table can be made available as a washer for ores as well as coal; in fact for any material to be washed where the valuable matter and the refuse are of distinctly different specific gravity.

In dealing with coal we have the following differences of specific gravity to consider. That of pure coal is from 1 p. c to 1.3 p. c., while slate has a specific gravity of from 2 p. c. to 2.7 p. c., and pyrites, or sulphide of iron, from 3.1 p. c. to 5.1 p. c.

The whole value of a washing machine lies in its ability to eliminate the sulphur and ash as largely as possible, particularly the sulphur. The ash is largely formed from slate. The sulphur occurs in the shape of solid pyrites, and also more or less as organic sulphur, which in our coals amounts to the definite amount of 1 p. c. The latter cannot be eliminated by washing and whatever amount of this there is in the coal will have to remain.

The great difficulty has been, heretofore, to eliminate the very light flaky particles of sulphur, which in many coals fill all the cracks with a film of yellow pyrites, and are also so thin and light that they have a tendency to float off with the coal. The solid pyrites, occurring in little crystals or aggregates of crystals, is the easiest to wash out. When, therefore, the coal contains this form of pyrites, the thorough washing becomes all the more difficult.

There is usually very little trouble in washing out the slate, though even here in some styles of washers there is always danger of the fine particles of slate being washed off with the coarser particles of coal, unless very great care is exercised in sizing, or rather, in crushing all coal to less than one-quarter inch in size.

The greatest difficulty experienced heretofore in many coal-washing plants has been the lack of recognition by many of their managers that their successful action is dependent entirely on uniformity of size, for it stands to reason that a piece of coal one-half an inch large requires as much pressure or current of water to carry it away, as would carry away a piece of slate one-third its size, or a piece of pyrites one-fifth its size. This fact, therefore, has always made it necessary with most other washers to grade the coal into its different sizes in order to attain the most satisfactory results.

In this machine the fine powdery coal, while of the same consistency as slate and pyrites, is given a chance to assert its lighter specific gravity and to float away with the current of water mixed with coal, and thus be saved in a form that makes it directly available.

If this table were to be applied to ore and rock, the conditions would be, in most cases, very similar, excepting that they would require a much stronger current of water, as the specific gravity of the ore and rock both being greater than that of the coal and slate—the ore representing in that case the pyrites and slate, and the rock representing the coal—it would naturally require a heavier current to carry away the specific heavier rock than the specific lighter coal, which it would represent, whereas the finer ore would act like fine pyrites and slate and pass through the riffles into the bottom built underneath. With this machine, therefore, it is not necessary to size the coal as closely as is the case for the successful operation of most other washers.

In giving you a description of the plant, I would like to say that I am indebted to my friend, Mr. O. F. Griem, superintendant of the Dominion Iron and Steel Company's coke ovens, for the data and details relating to same.

The raw coal from the mines is received in the form of slack, varying in size from zero to one inch. This slack is dumped into a pit under the coal track and elevated to overhead bins, known as the raw coal bins, and from these the raw coal is drawn and passed over a grizzly, which removes all coal from one-quarter inch to zero, the balance going to the rolls. The rolls are of the corrugated type and are four in number, arranged in a single row, end to end, in pairs of two, and these reduce the coal to the same size that passes through the grizzly, namely, not larger than one-quarter inch.

Each pair of rolls is provided with a hopper beneath, into which all the coal that passes through the grizzly is discharged. These hoppers form the "boots" of the elevators, elevating the coal to the long bin above the washers. The washers are suspended from this bin by swinging suspension rods, and each washer or "bed" as it is called, is provided with an adjustable chute, having a one-inch water pipe arranged at the point of junction of the chute to the bin. The object of this water junction is to stir up and sluice the coal down to the beds in uniform quantity, and at this point of entrance of the water a small slide-valve is inserted, by means of which larger or smaller quantities of coal can be let down over the chute into the bed.

The beds are nine feet long and thirty inches wide, being suspended at their four corners on rods, so that they are free to move backwards and forwards in a lateral direction. This head, or bumping end, is connected with a rod to a loosely hung rocker arm, the free end of which engages a peculiarly designed cam, which is mounted upon a shaft driven by motor or engine. This rocker arm is adjustable, so that one can give a longer or shorter swing to the bed.

The bed proper consists of a central timber or "keel" as it is called, upon which are fastened crosswise, in the manner of a fish bone, five or six strips, eight inches wide and thirty inches long. Upon these cross pieces or strips is fastened a sheet of galvanized iron, which constitutes the bottom of the bed. Upon the top of this sheet iron, three narrow strips are secured, running lengthwise with the bed, one in the centre and one at each end of the cross pieces, and upon these strips in turn are mounted the riffles. These riffles constitute a false bottom and consist of triangular oak strips, and have an over-lapping strip of galvanized sheet iron fastened to them.

The riffles are set one-eighth of an inch apart, and this space is the means of communication with the hollow space between the bottom of the riffle and the sheet iron bottom of the bed. The sides of the beds are six inches high, and the construction of the top side of the keel is such as to give the riffles and the bottom a slight curvature, and the whole resembles a trough with a serrated bottom.

In the operation the cam is rotated and imparts a backward and forward motion to the bed, through the rocker arm and reach rod connecting them.

The coal being sluiced to the bed with water, the bed soon fills, and the cam motion is such that the bed is brought at regular intervals of time, about sixty strokes per minute, against a block or bumping-post of heavy timber. This serves to agitate the mass upon the table, allowing the heavier impurities in the coal to settle upon the riffles. At each successive blow the slate and pyrites are caused to move up towards the bumping end, the riffles all being set in that direction, until they are finally discharged over the end of the bed into the refuse sluice, while the lighter coal flows with water to the lower end of the bed in the form of a fan-shaped sheet, covering the whole width of the bed. This serves to wash back any larger pieces of coal which have a tendency to move up with the slate.

The fine pyritic flakes and other pulverized heavy impurities pass down between the riffle spaces to the sheet iron bottom, from whence this material is discharged.

The beds have a capacity each of five tons of washed coal per hour, making each bed's work in ten hours equivalent to fifty tons.

The amount of refuse, including what coal is carried with it, is about forty-five per cent., so that each table washes about fifty-two tons of coal per day.

The raw coal, as it originally enters the tables, contains about 6.50 p. c. of ash and 2 p. c. of sulphur. As it leaves the table it contains about 3 p. c. to 4 p. c. of ash, and 1.2 p. c. to 1.4 p. c. of sulphur.

The refuse contains about 40 p. c. to 45 p. c. of sulphur, the balance of about 35 p. c. to 40 p. c. being coal. This, on about 4 p. c. of loss, means a total loss of about seven to eight tenths of a ton of coal to each washing-table per day.

In order to be able to utilize the lost coal in the refuse, the amount of this can be raised in the washing so as to increase the loss to say 6 per cent., which will give a purer coal, but leaving more coal in the refuse. This refuse can then be rewashed roughly on the rewashing beds, so as to get the refuse practically free from coal, and a coal containing anywhere from 3 per cent. to 4 per cent. of sulphur and a proportionate per centage of slate, or with say 60 per cent. to 70 per cent. of coal, which latter can then be used as fuel under the boilers, where this additional percentage of impurities does no material harm, in view of the saving of fuel thus effected.

The construction of these beds is very simple, and the average cost of a bed is estimated at fifty dollars.

The beds are called Campbell Washers, and are controlled and patented by Hyle and Patterson, of Pittsburg.

Notes on the History of Manganese Mining in part of Nova Scotia, and on some of the Geological Conditions of the Manganese Belt running through Hants County.

By W. F. Jennison.

(Read 19th February, 1903.)

The existence of manganese ores in Hants county, N. S., has long been known. In fact, it is hard to ascertain at just what date the ores were first worked. Legend says that Hants county has the honor of being the first producer of manganese in America. The story goes that the French used *savon de verriers*, their fanciful name for pyrolusite, in making glass and pottery at Piziquid, now Falmouth, Hants county, before the expulsion of the Acadians in 1755.

It is evident from history that the French used manganese in this country, but for what particular purpose and at what date, we have no reliable authority, and know but little of its discovery or history in Nova Scotia until 1861, when it was found at Tennycape.

Dr. Henry How, in his "Mineralogy of Nova Scotia," (page 111,) tells us that in 1861 Mr. Nicholas Mosher, jr., of Avondale, brought him some samples from Tennycape, which Dr. How told him were good manganese ore. On diligent search he found the ore to occur in nodules, from the size of a bean to that of twenty-four pounds, a sample of which was sent to the exhibition in London the following year. The first shipment of about eight tons was sent to Windsor to be transhipped to England in 1863. An average analysis of this ore gave 91 per cent. oxide, and sold in England for £8 10s., and £9 per ton. Messrs. Tennant, of Glasgow, are reported to have said they had never seen ore so fine.

Since that time, Tennycape has been worked intermittingly and has been the best producer in Nova Scotia.

Tennycape is situated about thirty-three miles from Windsor, on the south side of Minas Basin. The manganese here occurs in the lower carboniferous belt beginning on the west side of the Avon River and running eastwardly in a tortuous course to the Shubenacadie River, having a length of forty-five or fifty miles.

The principal deposits on this belt, mentioned in order of their importance, are the Tennycape and the Pembroke, both of these owned, controlled and worked by the Tennycape Manganese Mining Company, Limited; the Churchill and Wm. Stephen mine at Walton; the Parker mine at Tennycape; the Cheverie mine at Cheverie; and the Scott property at Minasville.

The outcrops of this belt are numerous and can be easily traced; but the deposits of manganese have their particular zones, and are not disseminated throughout the whole belt, as miles of the limestone may be found not carrying any appreciable amount of manganese.

As regards the occurrence of manganese in this belt, I must differ from the general opinion of many eminent authorities that manganese is always found in pockets. In this particular I will confine my remarks to Tennycape and Pembroke, which I had a special opportunity to study. The limestone belt here, which varies in thickness from 150 to 300 feet, may be divided into three distinct sub-divisions, and in each sub-division the mode of occurrence of the manganese is quite different from that of the others. Immediately overlying this belt are masses of gypsum, and what is known as the foot-wall is Devonian quartzite.

Beginning at the top, the first sub-division is a brecciated limestone about sixty feet thick. This is known to the miners as the "soft ground." In this the manganese occurs in round masses or pockets, from the smallest to the largest size. The famous Dykeman pocket, about one thousand tons, was taken from the grounds at Tennycape. When the pockets are taken out not a perceptible trace of manganese can be seen, and nothing to lead one to discover another deposit.

Under this is a massive limestone, which the miners term "white rock." At Tennycape this is about seventy-five feet thick, color light grey, and its solidity is such that in drifting or sinking in it, very little, if any, timber is required. In this the ore occurs in lenticular veins, having a regular dip and strike, varying in thickness, sometimes pinching out to almost nothing, but always leaving a "leader" to follow.

Although the rock here dips south at an angle of from 45 to 60 degrees, yet the ore veins dip north, generally at high angles, at the same time having deepening inclination westward. Within a distance of two hundred and fifty feet, I have followed the inclination of one of these veins from the surface to a perpendicular depth of one hundred and sixty feet—the deepest workings at Tennycape at that time.

Under this, and separated from the Devonian quartzite by a few inches of clay, is a laminated limestone, known to the miners as the "slate belt," having an average thickness of fifteen feet, carrying numerous regular veins of very high-grade ore from the smallest size up to five or six inches, running in all directions. This, possibly, is the most valuable of the three. It has been estimated that if the entire belt were taken out and concentrated, it would yield from 15 to 20 per cent. ore, yet it has never been worked to any extent.

Admitting that the conditions here are very different from those of many other deposits in both Canada and the United States, yet knowing and closely watching these conditions, modifies very much the old opinion that manganese mining is most uncertain and that we never know what should be done next when mining this mineral.

The workings of Tennycape consist of one main shaft, one hundred sixty feet deep, with levels running east eighty feet and west about one hundred and ten feet. This ground has been fairly worked out to the surface, except what is known as the "slate belt."

One hundred and twenty-five feet east of the main shaft is another ninety feet deep. From it the levels run west to connect with the workings of the main shaft, and east about one hundred and twenty-five feet.

As to the plant, one would judge from the appearance of it, that the Egyptians were not only the first discoverers of manganese, but that they had first mined the mineral at Tennycape, and that no improvement had been made in the plant since that time. No modern concentrating plant has ever been installed, and what has not been saved at the cobbing table has practically gone into the waste dump. These dumps have been estimated to contain fifty thousand tons of material, which will yield 10 per cent. ore. Why a modern concencrating plant has not been installed in a mine with the possibilities of this one, is hard to explain, for it is a mine which has been known to the world for over forty years, and whose ores have sold in the United States as high as $140 per ton, and never less than $40 per ton, and which can be treated with at least some degree of certainty of workable profit.

Stamp Milling Practice in Nova Scotia, and the Advantage of Introducing Water under Pressure below the Crushing Surfaces in the Gold Stamp Mill.

By M. R. O'SHAUGHNESSY.

(Read 19th February, 1903.)

At the request of a number of our successful Nova Scotian gold miners and leading members of the Mining Society, I submit for their consideration the following notes on Nova Scotian practice in wet-crushing stamp mills:—

These notes may prove useful and instructive to possible investors and mining men who have no practical knowledge of stamp milling Nova Scotian ores. I use the term "ores" as applying to all material removed by mining operations that eventually passes through the mill. The extraction and recovery of values in gold from our ores by stamps, does not always get the serious consideration that it justly deserves.

It is not my intention to impose on the time of the society, but, that my notes may appear clear and be readily understood by the men now before the stamps in our scattered mining camps, it will be necessary to call attention to the two different types of mills now in use, namely, the light mill, equipped with 650 lbs. to 700 lbs. stamps and capable of pulverizing one and a half tons per stamp in twenty-four hours, and the modern heavy high-speed mill, equipped with stamps ranging in weight from 850 lbs. to 1100 lbs., capable of pulverizing from two to four tons per stamp in twenty-four hours.

But the question may be asked, How does the heavy mill differ from the light mill in the pulverization of ores and collection of values in gold? A brief description of the practical working of the two mills will be necessary at this stage to demonstrate the relation one mill bears to another.

I will first take up the practical working of the *light mill*, and endeavor to point out that this mill in general use previous to the introduction of the modern heavy mill, was not, and is not to-day, when intelligently operated, the "old trap" that a great many miners believe it to be. As you are well aware the extraction of gold from our ores depends, with a few exceptions, on the one machine, namely, the stamp mortar with plates and in all cases where the mill is in an isolated district, the one that appears best adapted to the extraction of gold is the light stamp and roomy mortar with a capacity of about one and-a-half tons per stamp in twenty-four hours, hand-fed preferably to automatic, unless a first-class automatic-feeder is installed.

Let us assume that the light hand-fed mill is ready for commission, and the writer is in charge preparing for a run. After determining that the thrust of stamps is directly on the dies, the fronts are placed in position, the base of mortar, including dies, is covered thoroughly with sand or pulp recovered from the mortar in a former clean-up, screens are examined, placed in position, and made secure.

One of the most important points in practical stamp-milling, is the protection of the gold after it has been liberated from the gangue by the action of the stamp. Such being the case, it will be apparent that in order to mill successfully, certain rules and regulations will have to be followed in the method of operating in order to secure the desired protection of the gold from the wearing action of the stamps and pulp in the mortar. One of the best methods to obtain this result is to take advantage of the law of gravitation. Nature having been generous to gold, has endowed it with extraordinary gravity, hence, all that is necessary to readily take advantage in the light mill of the laws of gravitation, and protect the gold after it is liberated from the ore, is to give strict attention in feeding ore and water during the first few hours' run of the mortar. By close or thin feeding for the first few hours, a stationary base is formed in the mortar. This base is the surface of the solidly packed sand that forms in all the mortars not otherwise fitted with appliances for preventing the stemming and packing of sands around the dies. By careful attention to feeding ore and water, it is possible to establish this base from one to two inches below the crushing surface of the dies, and, if care is exercised throughout the run in feeding ore, supplying sufficient water at all times to meet the requirements of the pulverized material, the material within the mortar will be displaced and washed by the action of the stamps to a depth of two inches below the crushing surfaces of the dies. One of the apparent advantages of the light mill is due to the easy pulsating motion given the pulp when properly supplied with water and ore. The liquid condition of the pulp allows the different atoms of the ore to find their relative position by gravity, hence the material having the least weight escapes from the mortar first and all particles of greater gravity are retained in the mortar the longest period of time and are reduced to the greatest degree of fineness. In nearly all our Nova Scotian ores, gold is closely associated with the sulphides of iron or other minerals which are retained longest in the mortar until almost reduced to slimes, thus liberating a large percentage of gold that owing to prolonged abrasion readily amalgamates. Its weight will readily find it a resting place on the base line of mortar, the crowns of the dies acting as riffles to arrest the particles, whether pure amalgam or sulphurets carrying a percentage of gold.

Any person familiar with the panning motion of the moving pulp in the mortar under displacement by the stamps in the light mill, can readily comprehend the advantage of an abundance of water on the crushing surface of the dies. It materially increases the efficiency of the mill as a pulverizer, by washing out the disintegrated parts of the ore on the surface of the dies when the stamps are not resting thereon. It readily adjusts the pulp uniformly under each stamp, and it is at this stage of the crushing that the mill-man should see that the base of the mortar is formed at least one and one-half inches below the crushing surface of the dies, and know that at all times sufficient water is being supplied to thoroughly wash the dies after each thrust of the stamps, as the displacing force of the descending stamps is the agency whereby the sand is mechanically displaced alternately from one die to another. It is only necessary to supply sufficient water and feed low or thin, to successfully displace the pulverized material after each thrust of the stamp. Such being the case, the liquid condition of the partially pulverized ore resting on the surface of the dies enables the broken or separated atoms of ore to take advantage of gravitation; and regardless of the agency of mercury, coarse and heavy gold readily falls a prey to the pockets created between the dies for the purpose of its protection after it has been liberated from the ore.

A large percentage of what is termed float-gold that escapes from the mill in the water, is created by the action of the stamps reducing the gold to minute particles before the active and expelling force of the stamps is enabled to discharge or lodge them in a place of safety on inside plates. Knowing, as we do, the soft malleable nature of gold, it is apparent that a large percentage of values escapes from poorly managed mills in the form of worn gold created by continuous exposure to the action of stamps and sands.

It will be apparent to any thoroughly practical, observant mill-man, that a great many of the difficulties surrounding the extraction and collection of gold in Nova Scotia is created by the very methods applied for the recovery of the values. As a rule, our gold-bearing ores may be considered practically free-milling, and a large percentage is coarse and granular gold, which, if protected from wear and tear, is easily recovered by the stamp mill wet crusher. If proper methods for the protection and collection by gravitation in the mortar of the coarse gold so commonly found in our ores, is put in practice, amalgation is only necessary for the finer and smaller atoms whose gravity is overcome by the action of stamps and which are expelled from the mortar through the screens. The conditions for early amalgamation are clear liquid and sharp pulp, so apparent in mortars supplied with low or thin feed, and an abundance of water to carry off the ever recurring slimes. In the majority of our mills the supply of water to the mortar is governed by the flow passing over the stationary plates that were probably placed in position during the construction of the mill in accordance with the practice of an altogether different district. The plates can only be used as an indicator of the proper supply of water required by the mortar, after a series of experiments have been made to determine the required volume, and in all cases it will require adjusting to suit different qualities of ore.

Another favourable feature in connection with the condition of the mortar as above described, is in regard to the quicksilver, the principal agent in the recovery of the finer particles of gold. There is no danger of creating losses through an over-abundant use of mercury when the mill is running under thin feed and the pulp is being displaced and washed two inches below the surface of the dies.

The moving pulp will suspend, or keep suspended, for a limited period of time the mercury so supplied, whether in small or large quantities, and whatever particles of gold mingled with the pulp are in like manner under suspension, will have an opportunity to become amalgamated with the mercury, if previous to the association the specific gravity of the particles of gold was sufficient for it to take a suspended position against the mechanical displacing or discharging wash of the mortar. Such particles of amalgam once settling or sinking below the crushing surface of the dies will be retained on the base of the mortar by the affinity of other larger or smaller deposits of amalgam or mercury, as the case may be, and by the specific gravity that has already been the chief factor in arresting the gold from being discharged after liberation from the ore. But too often, through carelessness or ignorance of the mill-man, the period of crushing is prolonged without a clean-up until the crushing surfaces of the dies have worn down to the deposits of amalgam and mercury collected between the dies and the values are churned out as the run is continued. By the method here described, the mill-man will recover probably seventy per cent. of the deposits and find the same adhering to coreholes and rough surfaces in stamps, shoes and dies, screen frames, and any rough surface that the pulverized amalgam may come in contact with inside the mortar, and lastly a large percentage adhering to plates outside the mortar. A portion of the loss may be recovered on concentrators at the tail of the mill.

Another common method of increasing the wear and tear of gold and the losses, is to start with the mortar running in a choked condition, either from too high fronts, insufficient water supply, or by supplying ore to the mortar in quantities and at periods that do not allow the water to reach the crushing surface of the dies. Under this method of milling or starting a mill run, it takes but a few hours to stem or thoroughly pack the mortar to the surface of the dies with the pulverized material in such a manner that nothing will remove it but bar and pick on clean-up day. In this condition of the mortar, what is the result when coarse granular gold is liberated from the ore? The activity or the discharging force of the mortar is not capable of removing it immediately out of harm's way; and if it were, the screens would not allow the gold to escape in its granular or coarser form. If inside plates are used, it has to become amalgamated before it will adhere to them, and if bulky and having sharp angles the wash of the mortar will not allow it to remain on the plates until some of its sharp corners become worn off. If mercury is supplied in larger quantity than the gold being liberated will take up, it will settle to the base (in this case the crushing surface of the dies); and if the quantity of mercury supplied happens to be much in excess of amount required, its presence on the surface of the dies forms slush amalgam. This slush amalgam resting on the crushing surface of the dies holds with a subtle grip small and coarse gold alike, to be thoroughly pulverized before being discharged or lodged on the inside plates. If, on the other hand, we do supply sufficient mercury to a mortar running under conditions to meet the requirements of the gold being liberated, we run the risk of the gold being pulverized or beaten into minute, thin sheets that will not combine with the mercury, and that will eventually escape unamalmagated.

In my opinion, the mill-man that can judge the happy medium in supplying mercury to the mortar run in conditions as above described, is not very much in evidence in our mining camps. In my practice I have found the light mill give best satisfaction by operating with medium fronts, fine screens, and abundance of water, thin feed, frequent beating-out of the mortar, and by avoiding too prolonged a run without a partial clean-up. In all cases I speed the mill to its limit with a reasonable drop of stamp, and depend on gravitation for the protection of the values when liberated from the ore. Twelve years of my twenty years' milling practice were spent before the light stamps, milling ores ranging from $1.00 to $2,000.00 per ton, and when the mill was operating continuously, one shift under my personal supervision, I never entertained any apprehension as to the result on clean-up days. In my practice I have always found the light mill give splendid results as a gold-saver and collector, when operated by methods that I have described in part as above.

Having devoted a good deal of space describing the working of the light mill, I will now briefly as possible describe the practical working of the *heavy high-speed mills* on Nova Scotia ores.

I may be asked, Why cling to the light mill in the treatment of our ores when our leading mining men have introduced the modern mill? I must admit that the modern mill is undoubtedly an improvement on the light mili when considered as a pulverizer of ore, and had our mining men confined the mill to the pulverization of the ore by a system of rapid, coarse crushing, and depended on secondary treatment for the recovery of the values in gold, a system or method of milling could be put in practice whereby the milling capacity of our mills could be almost doubled, and conditions under which losses may now occur avoided.

At the time of the introduction of the modern mill into our mining camps, men and owners made a general movement to retard the crushing capacity of the mill, practically defeating the very end they were seeking. In the first place they got the idea that the rapid high-speed of the mill brought about the expulsion of the gold before mortar amalgamation had taken place; thus they jeopardized the chances of recovering values on the outside plates. To remedy this trouble, coupled with a great many more imaginary difficulties, they reduced the speed of the mill, in some cases from twenty to thirty per cent., never thinking for a moment that in so doing they were practically checking the displacement of the pulp from one die to another and choking the mortar unless the greatest precaution was exercised in feeding the ore. The reason for this condition of the mortar in the modern mill when speed is reduced, is the difference of design in the cam of the improved mill compared with the cam of the old type of mill. For example, the period of rest of stamp on the dies in the old mill, dropping eight inches and making 60 drops per minute, is about equal to the modern mill dropping six inches and making 110 drops per minute. It will be apparent, that in order to ensure satisfactory displacement of material under the stamps and to enable sufficient water to reach the crushing surface of the dies, especially in mills not equipped with improved methods of supplying water to the mortar, the stamp should be lifted the moment the descending stamp has been retarded by the material on the dies, and the slowing down of the improved mill is a serious mistake. It not only deadens the activity of the pulp in the mortar and retards the crushing capacity of the mill, but where slate is present throughout the ore it also brings about a pasty, mucky condition of pulp on the surface of the dies, due in a great measure to an insufficient supply of water to wash out the disintegrated material after each thrust of the stamp.

Mortars running under such conditions practically stem or pack solidly all recesses between the dies, and the crushing surface of the dies forms the interior base of the mortars. In such cases where a sufficient quantity of water fails to reach the crushing surface of the dies it matters little what the interior form of the mortar is, for the pulp itself will build up a design of solidly packed sand, converting the interior design above the surface of the dies into what resembles very much a farmer's dug-out pig trough, and in such a trough a good share of our Nova Scotian gold-bearing ores have been pulverized since the introduction of the modern heavy mill.

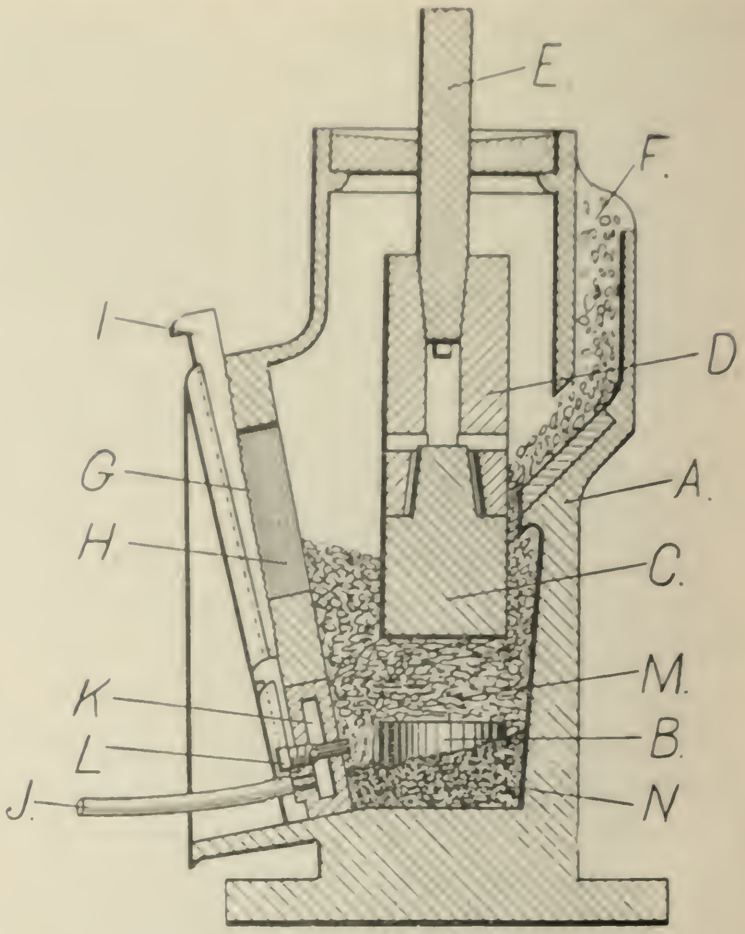
High fronts and fine screens have been used to prevent the gold escaping from the mortar. High fronts and fine screens are conductive to fine grinding, and no doubt liberate a large percentage of gold that would otherwise escape in low fronts and coarse screens. When, however, you increase the height of your fronts and use closer screens, you also increase the difficulty of having a sufficient supply of water reach the crushing surface of the dies to thoroughly wash out the disintegrated particles of pulp after each thrust of the stamp, and also to keep the base below the crushing surfaces of the dies, so essential to the protection of the coarse particles of gold so common in our ores. The question is before me at all times, Do we, by raising fronts and using finer screens and subjecting all the gold values to the pulverization action of the stamp during the period of the run before the clean-up is made, lose in float gold (or what I term the wear and tear of gold) an equivalent in values equal to what we liberate by fine grinding ?

The first difficulty that I encountered in the improved mill was the protection of values after being liberated from the ore. This difficulty was chiefly due to stamming and packing of the sands between the dies, which, without constant attention to automatic feeders, I could not avoid.

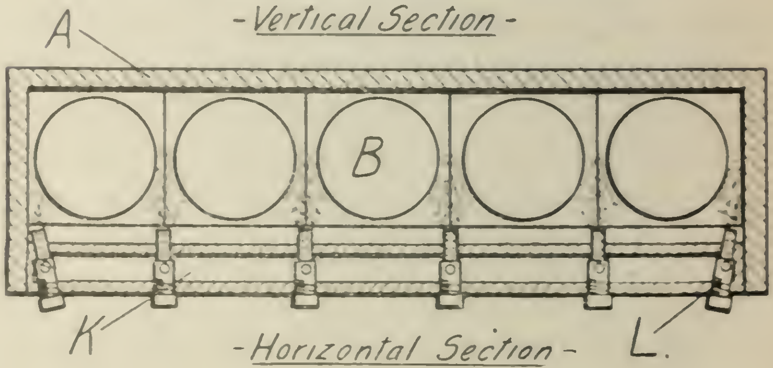
With this difficulty continuously before me in operating the modern mill of the Tudor Gold Mining Co. at Waverley during the summer of 1895, I conceived the idea of putting in some form of agitator to continuously disturb the sand between the dies in such a manner that any atoms of the ore having extra gravity would readily find a safe place from the action of the stamps and the severe abrasion of sand.

After utilizing what little mechanical inventive genius I possessed, I finally decided that the water usually dropped or directed into the mortar on top of the pulp, if directed into the mortar by means of a series of small jets or nozzles at any desired point below the crushing surface of the dies, would bring about the desired agitating result, supplying a mechanical agency whereby I could be assured that at every stage of the mill-run all coarse particles of gold would be recovered without the agency of mercury, and that a sufficient quantity of clear water was being directed on to the surface of the dies to wash out the disintegrated particles after each thrust of a stamp.

I have also found that under any condition of feed, height of fronts, or fineness of screens, the water directed under pressure, as herein described and shown in the accompanying illustration, will at all times during the run of the mill keep the recess between the dies so freely agitated that battery iron, nails, and gold in small or coarse particles readily become deposited between the dies, and if any reasonable attention is given to the



-Vertical Section-



-Horizontal Section-

A Mortar. *B* Die. *C* Shoe. *D* Stamp-head or boss. *E* Stamp rod. *F* Feed opening *G* Screen. *H* Screen opening. *I* Battery key or key wedge. *J* Water supply pipe. *K* Water chamber. *L* Water jet or nozzle. *M* Ore under action of stamp. *N* Gold and heavier particles of ore lying protected about base of die.

supply of ore to the mortar there will be found little or no difficulty in keeping the wearing surface of the dies and the stamp-shoes perfectly square or level. I maintain that the capacity of the mortar is also increased because of the presence of clear water directed into the pulverized material immediately after the thrust of each stamp. By this system of water supply, the material under the stamp, while being displaced alternately from one die to another, has to pass through or take with it a fountain of clear water. Hence, it should be apparent to every practical man that the heavier ore will readily sink into recesses between and around the dies.

As an example of what can be done in a mortar supplied with water directed under pressure as herein described, the following may be of interest :—During the month of November, 1900, I superintended at Renfrew the Thompson clean-up of 2700 ounces of gold bullion and made a practical test of one battery of five stamps, dropping five inches and making 110 drops per minute, with 6-inch fronts and No. 37-mesh screens. From one run of an hour and twenty minutes on specimens, I received one bar of gold bullion weighing 666 ounces. Of this amount 95 per cent. was recovered below the crushing surfaces of the dies, about 2½ per cent. was attached to the interior of the screens, and the balance of 2½ per cent. was on the outside plates. The run was witnessed by three men besides myself, and I consider the run practically showed the thorough protection coarse grains or even small particles of gold get in a mortar supplied with water directed under pressure below and between the crushing surface of the dies. In the majority of cases where the tailings from mills are not subjected to a secondary treatment to recover values lost by coarse crushing, I contend that by applying the water as herein described, the stamps could be allowed to reduce the ore to a slime, and yet not injure the values in gold ; and when clean-up day came, the gold would (with the exception of a very small percentage which fine grinding had liberated and discharged on the outside plates) be found deposited between the dies in particles still having their sharp angles, and as free from wear as when first liberated from the ore.

Limits of the Workable Coals of the Cumberland Coal Fields in Nova Scotia.*

By HUGH FLETCHER, Geological Survey of Canada.

(Read October 27th, 1903.)

No originality is claimed for the views here presented which have been either clearly stated or hinted at by such competent observers as Sir William E. Logan, Abraham Gesner, John Rutherford, Professor H. Y. Hind, Sir J. W. Dawson, Scott Barlow, Walter McOuat, Dr. R. W. Ells, Dr. H. S. Poole, Dr. E. Gilpin, and others, and are at once suggested by geological maps of the district. As the facts are frequently overlooked or ignored by explorers who still search for coal only near the surface in a region, easily accessible and long explored, in which mines have been worked for many years and no important recent discoveries of coal have been made, I may call your attention, as practical miners and explorers of a province noted for the large production of minerals in proportion to its area and population, to a few points brought out by investigations. These have lately been made to define the structure of the southern rim of the Cumberland coal basin and test the probability of finding along it coal seams that do not come to the surface, but are apparently buried beneath overlying rocks.

The strata of the great section of the Joggins coast, which have an aggregate thickness of about 15,000 feet, may be subdivided as follows in descending order :—

Permian or Upper Carboniferous,
Coal Measures,
Millstone Grit,
Carboniferous Limestone or Lower Carboniferous.

They lie in a basin on the north side of which the coal measures dipping south at an inclination varying from 45 degrees to 16 degrees, extend eastward about twenty miles from the shore at the Joggins mines, while on the eastern or Springhill side they strike southward to within a short distance of the Cobequid Hills and dip westward for the most part at an angle which seldom exceeds 30 degrees.

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* Revised by Mr. Fletcher, February, 1904.

The main seam of the Joggins mines is overlaid by 4740 feet of sandstones and shales, of which 2473 feet in the lower portion include small seams of coal. The top of these overlying rocks is at Shulie, eight and a half miles distant, and southwestward from that place they follow the shore in nearly horizontal attitude for some miles, then in descending order form a section which seems to repeat the foregoing rocks for a distance of about twenty miles as far as Apple River and Spicer's Cove, giving a thickness of perhaps 3500 feet of uniform colour, composition and texture. At the base 500 feet or more consist of conglomerate, composed of large pebbles and blocks of the Devonian granites and felsites, which immediately south of Spicer's Cove form the western limit of the Cobequid Hills.

The only regular coals southwest of Shulie are found near Spicer's Cove, immediately overlying this conglomerate.

These small and otherwise unimportant coals suggest questions of great practical value. What is their relation to the large seams of the Joggins and Springhill mines? If the latter could be reached by a shaft or boring 4740 deep in the basin at Shulie, can they be cut nearer the surface at Spicer's Cove and elsewhere? Have they thinned out and been replaced by conglomerate in this direction, or have they been cut off by a fault?

A general section from Minudie to Apple River faces page 150 in Dawson's Acadian Geology, which is also applicable to any line from the Cobequid Hills northward to the coal seams between the Joggins and the Styles mines; several broad folds, however, in some places repeating the rocks between the shore and the hills are shown on the Apple River sheet just issued by the department of the Geological Survey (Nos. 100 and 101).

Dawson's section makes most of the rocks southward from Shulie River to Spicer's Cove equivalent to the uppermost rocks from Shulie northward and shows a small coal seam near the bottom, but it does not prolong the Coal Measures beneath them and the text speaks of "conglomerates and other Lower Carboniferous rocks" as forming the southern edge of the trough and resting on these the beds of the coal formation still dipping to the northward. May not the conglomerates, however, be younger, overlapping in places rocks which include workable seams of coal?

To test these strata which are cut across by the Shulie, Hebert and Maccan Rivers, two boreholes were begun in the autumn of 1903. The first at Spicer's Cove, still in comglomerate, is now over 500 feet deep.* Another, twenty-seven miles to the eastward on the west side of River Hebert, one mile** below the outlet of Fullerton Lake, is about 600 feet deep. The latter is about three miles north of the Devonian metamorphic rocks and only twelve miles west of the Springhill coalfield where the uppermost coal seams have also been traced to Rattling Brook and, on Upper Maccan River, to within three miles of the Devonian rocks of the Cobequid Hills.

To the eastward of Springhill the Coal Measures are underlaid by Millstone Grit and Lower Carboniferous rocks on what Professor Hind has defined as an anticlinal dome,† the result of intersecting cross anticlinals. They include the small seams of coal exploited at Polly Brook, Oxford Junction, Big Lake and other points, which overlie a comglomerate at the base of the millstone grit and form the bottom of another basin on the east side of the dome. But none of the large seams re-appear before Thompson Station is reached, where these rocks are apparently overlapped unconformably by Upper Carboniferous red comglomerate, sandstone and shale, in a basin extending thence to the Pictou coal field.

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* About 730 feet deep on June 11, 1904.

** About 1725 feet deep on June 11, 1904.

† The Nova Scotian Mining Number, Oct., 1903, page 30.

Here again a problem of great importance is presented. Do seams of coal of workable size exist at an accessible depth in this second basin, east of the Springhill dome, and within which new coal mines may be established?

The chance of reaching, even at a great depth, coals like those of Springhill and Westville, appears to be worth the cost of trial boreholes south of Big Lake and Dewar River. On the other hand, success cannot with certainty be predicted at any point because of irregularity of thickness of the seams, such as is characteristic of both the Pictou and Cumberland coal fields. In tracing the Coal Measures eastward a few miles from the Joggins mines, for example, we find that the seventy coal seams there exposed nearly all disappear, and that a mass of conglomerate, estimated to be 1500 feet thick, replaces the fine, soft strata of the shore. Moreover, in many places Permian rocks rest directly upon others older than the Coal Measures: and it is possible that the latter may occupy only unimportant areas within a workable depth. Yet the money ineffectually spent year after year in shallow borings and diggings by the holders of leased areas would be sufficient with the aid of the government drills, economically operated, or by means of deep holes bored by contract, to prove more than can be done in any other way.

DISCUSSION.

MR. FLETCHER illustrated his remarks by detail maps of the region, the inspection of which led to a strong desire being expressed for their immediate publication.

At the conclusion of the paper a dissussion took place on the work of the Geological Survey in Nova Scotia. (See p. 61).

J. A. JOHNSON.—I move that the thanks of the society be given to Mr. Fletcher for coming here and giving such an interesting address in relation to his work in Cumberland County.

HON. S. H. HOLMES seconded the motion, which passed.

A Trip to West Virginia.

By Henry S. Poole, D. Sc., F. R. S. C.

(Read 27th October, 1903).

A traveller in a country new to him is naturally most interested in the features which are unfamiliar, while such as are similar to those amid his own surroundings are accepted as matters of course. The few remarks I may make are from this point of view, and will be limited to circumstances and practices differing from those in force with us To the structure of the country is due much of the novelty that is associated with coal mining in West Virginia. Instead of digging down to lower depths and erecting machinery to hoist coal and pump water up to the surface, the miner of that country does all the hoisting that is done in himself, in climbing the hillside to his work; and then he finds appliances for lowering the product of his labor to depths of hundreds or perhaps 1,000 feet.

The structure of the coal field is due to the foldings of the Appelachian mountains, carrying on their western flanks strata of the Carboniferous, which were elevated to a general level of some 3,000 feet above the sea. The mountain folds gave a course to the streams, which now flow in valleys far below their crests, only breaking across the ranges by "gaps" at rare intervals. These streams make their way to the main drainage of the continent, and are joined by tributaries flowing with the gentle dip of the measures to the north-west at right angles to the axes of the folds. Creeks, forks and branches gather the waters of the ancient plane, and from their fountain heads have deeply carved it into V-shaped valleys. The country lies to the south of the region glacier-bearing during the Pleistocene period, and no foreign till cloaks the surface to cover up and hide the outcropping of the horizontal coal-bearing beds. The absence of erratics and far-carried stones is a noticeable feature to anyone disposed to speculate as to the origin of the boulders that strew the fields of New England and Eastern Canada. The streams that flow on the immediate flanks of the western ranges, having cut through all the strata of the carboniferous, have exposed to view members of the Devonian system, and thus it is that the lowest series of coal seams are only found high up on the eastern hill-tops in isolated patches; but as the inclination of the strata is uniform, some 60 to 80 feet to the mile, it soon brings the lowest of the beds near the bottom of ravines, and then the gentle dip continuing to the northward a few miles further sees them entirely under water. It is of interest to note that the general opinion of the country, shared in by the officers of the geological survey, is that the disappearance of these coal seams below water level of the streams is coincident with their diminution of thickness.

The several groups of coal seams vary in quality with their position in the series. The lowest are very low in volatile matter to be coking coals, and they are also low in ash. They supply the celebrated New River and Pocahontas coke and smokeless coals, of which we hear so much, as shipped at Newport News and Norfolk. A broad strip of barren measures then succeeds them, and this in turn is overlaid by another series of seams, much higher in volatile matter and supplying excellent gas coals.

To find inland markets for the coal of this field, it has to be carried long distances, and even for shipment by vessel the coal has to be conveyed 350 to 450 miles. For this reason preference is given to trucks or cars of large size, of 80,000 and 100,000 lbs. capacity, a train of coal being made up of 20 or 25 of such cars. These cars are in some cases made wholly of steel, and in others the body is of wooden planking on a steel frame. Of the relative merits of the two makes there is a diversity of opinion, the question largely turning not on the durability of the car, but on the ease with which it can be destroyed in case of wreck and the necessity of getting the single line of railway track quickly clear and reopened for traffic. While the wooden car may be readily cut up or repaired, or burnt to get it quickly out of the way, the steel car is apt to get so twisted in a wreck as to be past repairing, and then is not easily broken up or moved aside in a cutting. To meet such an emergency, by no means unfrequent, wrecking trains are now equipped with pneumatic tools to expedite the work.

The steel cars now made to carry an equal quantity of coke are fitted with four pairs of bottom doors to accommodate the necessarily greater length.

Everyone knows there are snakes in Virginia, where the puff adder still basks on the bankside in the early morning sun, and the black snake rests his length in the shade, indifferent to the passer by on the bridle path; but the rattler has given warning so often to his own death that now he is seldom met with, except in the rocky ravines.

Speaking of paths, recalls to mind the charms of the virgin forest, man's ancestral home, which there has great trees, straight and tall, of poplar and oak, three and four feet in diameter, surrounded by younger members of the family growing up to take the monarch's place in the centuries to come. To find one fallen is rare indeed, unless it bears the mark of man's axe, for the last natural death occurred so long ago as to leave no crumbling trace remaining now. Compare this primeval scene with one of our own woodlands, strewn with windfalls, impenetrable with underbrush, and puncturing the skies with sad rampikes. For the mines of Virginia, pit props and puncheons growing to required sizes as with us, are unknown, but large trees are cut in suitable lengths and split into "bars" with which to do the timbering underground.

The labor problem receives special treatment in parts of Western Virginia, and capital recognizes the importance of dealing with the walking delegate and his disturbing influence. In some of the valleys the stranger is made quickly to understand the atmosphere is for him unhealthy, unless when asked his business, his answers are frank and satisfactory. The man who posts a notice calling a meeting of miners quickly realizes the order of his going, and the workman who should happen to drop in at any such meeting and air his views, finds his money ready for him and his place occupied next day. There is no hesitation. In one section a strike was started a year ago, and although the strikers were still out and in receipt of relief from the Union, the mines were all at work and the output only dependent on the car supply. There were, however, signs of the strike to the initiated, and they consisted of sentry-like boxes standing by the wayside, in command of the approaches by road and rail. These shelters were occupied by burly armed men to interview the stranger. Then there was one structure more elaborate than the rest, a martello-like tower on stilts, fitted out with search light and gatling gun. Stationed on a high mound, it commanded the entrance to the mine, the village and the approaches, and it was further protected by an insulated wire fence charged with 500 volts from the mine dynamo. Up to the time of my visit, the only casualty was a cow. In the meantime the men on strike drew their rations, and either loafed or farmed.

In my own case, although never before had I been in a position to be mistaken for a walking delegate, I was given a pass to save me from possible annoyance. What that might be I formed some idea from hearing a fellow-traveller in a stage recount his experience, how that he had been accosted on his arrival the preceding day and requested to explain the object of his visit. His explanations seemed to have been accepted until evening shades prevailed, when a further enquiry was made whether his business there was completed. On his replying that it was, and that he proposed spending the night with a relation, his interrogater would not think of it, and he felt constrained to pass outside the assigned limits.

Coke-burning, although not an unfamiliar process, had its exceptional features in the long rows of ovens, occupying the bottom of the narrow valleys, which by night lit up the way that by day had a pall of smoke hang over it more and more dense as one passed westward. The greatest surprise, however, was occasioned on seeing blocks of new ovens going up beyond rows showing no signs of ever having been used. What did this seeming waste of capital mean? It was incurred to base a claim on the transportation company for additional coal-carrying cars, the practice being to allow one car for every five ovens at the mine, whether in use or not.

DISCUSSION.

A. DICK.—The ease of mining coal in Virginia and its consequent economy, is somewhat neutralized as compared with Cape Breton by the distance of the Virginia mines from tide water, so that Nova Scotia can hope successfully to compete in the markets of the world.

DR. POOLE.—It costs from 55 to 90c. per ton to mine coal in Virginia, and the price for carrying it to tide water, including shipment, is $1.35 per ton.

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